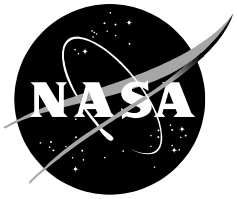
NASA/SP—2010–7603



NASA Scientific and Technical Information

Scope and Subject Category Guide

December 2010

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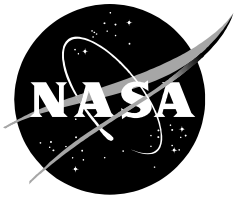

NASA Scientific and Technical Information

Scope and Subject Category Guide

National Aeronautics and
Space Administration

December 2010

Available from:

NASA Center for AeroSpace Information
7115 Standard Drive
Hanover, MD 21076-1320
443-757-5802

This report is also available in electronic form at

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Introduction

The NASA scientific and technical information (STI) *Scope and Subject Category Guide* is a high-level classification scheme for aerospace materials contained in the NASA Aeronautics and Space Database. It identifies and summarizes the subject interests of the NASA STI program. In that capacity, it serves as a guide for the acquisition of report and published literature along with other types of materials.

The two-level classification scheme includes 10 broad subject divisions, further divided into 76 specific subject categories. Each subject category includes: 1) the category number and its corresponding subject category name; 2) the description and definition of the subject category, along with cross-references to related subject categories; and 3) NASA's level of interest in more specific subject areas.

- "Exhaustive Interest" subject areas lie almost wholly within aerospace science and technology. Most materials on these subjects will be of interest and should be maintained in the NASA collection.

- "Selective Interest" subject areas are broader than NASA's direct interest in aerospace science and technology, but some may bear on one or more NASA programs. Materials on these subjects will be selected carefully to assure that suitable resources are maintained in the collection.

- "Negative Interest" subject areas are of no interest to NASA's program and will not be included in the NASA collection. Materials on these subjects will be selected occasionally, only if based on a specific, direct application to a specific NASA project.

Each category also includes "Input Subjects of Specific Interest," which are representative subjects that further support the identification of NASA's interests within that category. A comprehensive index of these input subjects, totaling nearly 3,000, is included at the back of the guide. This portable document format (PDF) version of the guide contains links in the index from each input subject to its corresponding category.

Comments on the content, organization, or features of this guide are invited. Contact the NASA Center for AeroSpace Information at help@sti.nasa.gov or call the NASA STI Help Desk at 443-757-5802.

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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; avionics and aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air). For related information see also ASTRONAUTICS (categories 12 through 20).

01 Aeronautics (General)

Includes general research topics related to manned and unmanned aircraft and the problems of flight within the Earth's atmosphere. Also includes manufacturing, maintenance, and repair of aircraft. For specific topics in aeronautics see categories 02 through 09. For information related to space vehicles see 12 Astronautics.

Definition

Aeronautics – The science and art of designing, constructing, and operating aircraft. *AGARD Multilingual Aeronautical Dictionary*, 1980.

NASA Interest

Exhaustive Interest: Aircraft production and new technologies related to maintenance and repair of aircraft; general discussions of atmospheric flight and aircraft, both manned and unmanned.

Negative Interest: Military deployment and tactics for aircraft.

Input Subjects of Specific Interest

- aeronautics
- aircraft maintenance
- aircraft manufacturing
- aircraft production
- aircraft repair
- maintenance (aircraft)

02 Aerodynamics

Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans, and other elements of turbomachinery. For related information see also 34 Fluid Mechanics and Thermodynamics.

Definition

Aerodynamics – The science that deals with the motion of air and other gaseous fluids and with the forces acting on bodies when the bodies move through such fluids or when such fluids move against or around the bodies. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: All information dealing with the effects of relative motion on the flow of air or other gases and vapors, at any velocity, over aircraft, air cushion vehicles, land transportation vehicles, spacecraft, launch vehicles, missiles, and their components; over geometric shapes of models used in laboratory and wind tunnel tests, e.g., cones, plates, shells, spheres, and cylinders; flow over rotors and other turbomachine elements; forces acting on bodies in aerodynamic flow, including aerodynamic lift and drag.

Selective Interest: Aerodynamics of ground support equipment for aerospace research, results of aerodynamic testing for these effects, or the aerodynamics of surface structures.

Negative Interest: Aerodynamics of ships and bridges.

Input Subjects of Specific Interest

- aerodynamic derivatives
- aerodynamic flow fields
- aerodynamic heating
- aerodynamic noise (airframe generated)
- aerodynamic studies of skin friction
- aerodynamic wakes
- aerodynamics of protuberances and substructures
- aeroelasticity (theory)
- aerothermodynamics
- air cushion vehicle aerodynamics
- air flow separation
- air launched weapons (aerodynamics)
- aircraft aerodynamics
- airfoil aerodynamics
- airship aerodynamics
- autogyro aerodynamics
- balloon aerodynamics
- boundary layer aerodynamics
- boundary layer flow (aerodynamics)
- buffeting
- canard aerodynamics
- cascade aerodynamics
- compressible flow (aerodynamics)
- control surface aerodynamics
- Coriolis forces (aerodynamics)
- drag reduction (effects and techniques)
- exit aerodynamics
- glider aerodynamics
- ground effect machine aerodynamics
- helicopter aerodynamics
- high speed aerodynamics
- hovercraft aerodynamics
- hypersonic aerodynamics
- inlet aerodynamics

- internal flow in turbomachinery (theory)
- laminar flow (aerodynamics)
- land transportation vehicles (aerodynamics)
- launch vehicle aerodynamics (for specific launch vehicles see 15 Launch Vehicles and Space Vehicles)
- lifting body aerodynamics
- lighter-than-air craft (balloons, airships) aerodynamics
- low speed aerodynamics
- missile aerodynamics
- parachute aerodynamics
- propeller aerodynamics
- reentry vehicle aerodynamics
- riblets (aerodynamics)
- rocket aerodynamics (for specific rockets see 15 Launch Vehicles and Space Vehicles)
- Rogallo wing aerodynamics
- rotary wing aircraft aerodynamics
- rotor aerodynamics
- sailplane aerodynamics
- sonic boom (aerodynamically generated)
- spacecraft aerodynamics (for specific spacecraft see 18 Spacecraft Design, Testing and Performance)
- stabilization surfaces (aerodynamics)
- STOL aerodynamics
- subsonic aerodynamics
- supercritical airfoils
- supercritical wings
- supersonic aerodynamics
- transitional flow (aerodynamics)
- transonic aerodynamics
- turbulent flow (aerodynamics)
- ultralight aircraft (aerodynamics)
- unsteady flow (aerodynamics)
- VSTOL aerodynamics
- VTOL aerodynamics
- wakes (effects of turbulent flow behind aircraft)
- wind tunnel tests (aerodynamics)
- wing aerodynamics

03 Air Transportation and Safety

Includes passenger and cargo air transport operations; airport ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in 09 Research and Support Facilities (Air). Air traffic control is covered in 04 Aircraft Communications and Navigation. For related information see also 16 Space Transportation and Safety; and 85 Technology Utilization and Surface Transportation.

Definition

Air Transportation – The conveyance of cargo and passengers by means of airplanes, helicopters, and other airborne vehicles. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

Aircraft Safety – Techniques used to prevent aircraft failures or accidents; the degree to which an aircraft is free of the risk of malfunction or accidents. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: All information dealing with air transportation, flight safety, aircraft accidents, and aircraft operating problems.

Selective Interest: Land transportation information that deals with transportation and safety to, from, and at airports.

Input Subjects of Specific Interest

- accidents and emergencies (aircraft)
- air piracy (incident or safety aspects)
- air safety
- air transportation
- aircraft accidents
- aircraft aging (safety)
- aircraft ditching
- aircraft durability
- aircraft emergencies
- aircraft health management
- aircraft in-flight collision
- aircraft licensing
- aircraft near miss
- aircraft operating problems
- aircraft safety
- aircraft search and rescue operations
- aircrew licensing
- aircrew training
- airport noise
- airport operations
- airport security
- airworthiness
- baggage handling (aircraft)
- bird collision (air transportation and safety)
- bird ingestion (air transportation and safety)
- cargo air transport operations
- cargo handling (aircraft)
- cargo transportation (aircraft)
- clear air turbulence (aircraft safety)
- collision avoidance (aircraft safety)
- crashworthiness (aircraft)
- ejection systems and seats (air transportation and safety)
- emergency locater transmitters
- escape systems (aircraft)

- explosions (aircraft)
- fail safety systems (aircraft)
- fire (aircraft)
- flight hazards (aircraft)
- flight safety (aircraft)
- flotation devices
- foreign object damage (FOD)
- foreign object ingestion (air transportation and safety)
- icing (aircraft)
- inspection (aircraft safety)
- lightning discharge on aircraft
- parachutes (personal and aircraft applications)
- passenger air transport operations
- passenger handling (air transportation)
- passenger transportation (air)
- public nuisance implications
- restraint harness (aircraft)
- runway safety
- safety systems (aircraft)
- search and rescue operations (air)
- seat belts (aircraft)
- severe storms (aircraft safety)
- shoulder harness (aircraft)
- survival (aircraft operations)
- taxiing (aircraft)

04 Aircraft Communications and Navigation

Includes all modes of communication with and between aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information see also 06 Avionics and Aircraft Instrumentation; 17 Space Communications, Spacecraft Communications, Command and Tracking; and 32 Communications and Radar.

Definition

Aircraft Communication – The conveyance of information to or from aircraft by radio or other signals. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

Air Navigation – The art, science, or action of plotting and directing the course of an aircraft through the air from one place to another. Adapted from the *United States Air Force Dictionary*. Woodford Agee Heflin, ed. Princeton, NJ: D. Van Nostrand Co., Inc.

NASA Interest

Exhaustive Interest: Information on development and utilization of communications and navigation systems for airlines, general aviation, and military aviation including air traffic control. Includes all techniques and equipment specifically intended for the transmittal of data to or from aircraft. For detailed equipment and designs, see 33 Electronics and Electrical Engineering.

Selective Interest: Communications and navigation techniques and theory of potential interest to aeronautical research and development.

Negative Interest: Commercial telephone operations; courier and messenger services; and ship navigation, unless related to aeronautics.

Input Subjects of Specific Interest

- air navigation
- air traffic control
- aircraft command and control
- aircraft communications
- aircraft tracking
- air-sea navigation
- airspace management
- all weather global position determination
- approach control (aircraft)
- celestial navigation (aircraft)
- collision avoidance (aircraft control)
- communications networks (aircraft)
- communications system (aircraft)
- Consol/Consolan navigation system
- Decca navigation system
- digital communications systems (aircraft)
- Doppler navigation systems
- electromagnetic devices (radiators, sensors and other equipment) for navigation systems
- global positioning systems (aircraft)
- ground based and space based radar for air navigation
- ground control approach (GCA) systems
- guidance system design (aircraft)
- inertial navigation systems (aircraft)
- inertial sensors and measurement units (aircraft)
- instrument navigation systems
- ionospheric effects on radio transmission (aircraft)

- laser communications systems (aircraft)
- laser tracking systems (aircraft)
- Long Range Navigation System (LORAN)
- man-machine communications (aircraft)
- microwave communications systems (aircraft)
- Microwave Landing System (MLS)
- microwave receivers (aircraft)
- microwave transmitters (aircraft)
- navigation computer systems (aircraft)
- navigation display devices (aircraft)
- navigation system design (aircraft)
- navigation systems (aircraft)
- Omega navigation system
- Omnidirectional Radio Range System (OMNI)
- passive sensors, trackers, and references (aircraft)
- radar communications systems (aircraft)
- radar detection (aircraft navigation)
- radar imagery (aircraft navigation)
- radar tracking systems (aircraft)
- radio communications system (aircraft)
- range and angle measurement (aircraft)
- sea navigation (aircraft related)
- speech analysis (aircraft voice communication)
- speech compression (aircraft voice communication)
- systems for adverse weather avoidance
- systems for collision avoidance
- TACAN
- telemetry (aircraft applications)
- terrain avoidance systems
- terrain following
- tropospheric scatter (aircraft communications/navigation disruption)
- very high frequency omnirange (VOR) navigation
- voice communications systems (aircraft)
- wave propagation (aircraft communications effects)

05 Aircraft Design, Testing and Performance

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology. For related information see also 18 Spacecraft Design, Testing and Performance; and 39 Structural Mechanics. For land transportation vehicles see 85 Technology Utilization and Surface Transportation.

Definition

Aircraft Design – The act of conceiving and planning the structure, systems, and performance characteristics of an aircraft vehicle or any other apparatus, machine or contrivance intended to be borne up either by dynamic action of the air upon the object's surfaces, or by the object's own buoyancy. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

Aircraft Testing – Testing by means of actual or simulated flight of an aircraft to see how the aircraft or any equipment used on an aircraft performs or tests of an aircraft component to determine its suitability or reliability in flight. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

Aircraft Performance – The manner or effectiveness with which an aircraft vehicle or any airborne structure, machine, or contrivance functions while in operation. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: Research, development, testing, evaluation, or performance of any complete aircraft, system, or component; operating problems that affect or are affected by design, development, testing, evaluation, or performance.

Input Subjects of Specific Interest

- aeroelasticity (property)
- aircraft components
- aircraft configurations
- aircraft descriptions (types/names/designations)
- aircraft design
- aircraft development
- aircraft evaluation
- aircraft flight tests
- aircraft performance
- aircraft simulation
- aircraft structures
- aircraft testing
- airship performance
- body-tail combinations (aircraft design)
- cabin pressurization (aircraft)
- deicing systems (aircraft)
- depressurization systems (aircraft)
- ejection systems and seats (design)
- expandable structures (aircraft)
- fins (aircraft)
- fuselages
- gliders (sailplanes, hang gliders)
- helicopter design
- helicopter ground resonance
- helicopter performance
- helicopter rotor dynamics
- Highly Maneuverable Aircraft Technology (HiMAT)
- hydraulic system (aircraft)
- inflatable structures (aircraft)

- in-flight simulation (aircraft)
- landing gear (aircraft)
- lifting bodies
- lighter-than-air craft (balloons, airships) design
- models (aircraft)
- noise reduction
- noise reduction (aircraft structures)
- pneumatic systems (aircraft)
- powerlift technology
- pressurization systems (aircraft)
- pressurized cabins
- remotely piloted vehicles (RPV)
- tail surfaces
- TAV (transatmospheric vehicles) (aircraft)
- tilt rotor aircraft
- tires (aircraft)
- transatmospheric vehicles (TAV) (aircraft)
- transition flight
- unmanned aircraft systems (design and testing)
- wheels (aircraft)
- wind tunnel tests (aircraft and components)
- wing-body combinations (aircraft design)
- wing-nacelle combinations (aircraft design)
- wings

06 Avionics and Aircraft Instrumentation

Includes all avionics systems, cockpit and cabin display devices, and flight instruments intended for use in aircraft. For related information see also 04 Aircraft Communications and Navigation; 08 Aircraft Stability and Control; 19 Spacecraft Instrumentation and Astrionics; and 35 Instrumentation and Photography.

Definition

Aircraft Instrumentation – Any electronic or mechanically-based instrument or instrument system designed for detecting, measuring, displaying, recording, telemetering, processing, or analyzing different values or quantities encountered in the flight of an aircraft; often supporting the general control of the aircraft. Adapted from the *Dictionary of Technical Terms for Aerospace Use*. Wm. H. Allen, ed., 1965. NASA SP-7.

NASA Interest

Exhaustive Interest: Design, arrangement, installation, and use of aviation electronics and devices for detecting, measuring, displaying, recording, telemetering, processing, or analyzing values or quantities characterizing the flight environment, vehicle state, or other phenomena encountered in aircraft flight.

Selective Interest: Instruments or displays and off-the-shelf equipment from other transportation media that could be transferred to, or modified for, aircraft use.

Input Subjects of Specific Interest

- airborne computers
- airborne radar displays
- aircraft control computer systems
- aircraft instrumentation
- aircraft systems monitoring instruments
- airspeed indicators
- alarm systems (aircraft)
- altimeters (aircraft)
- analyzing devices (aircraft)
- anticollision devices
- attitude indicators (aircraft)
- avionics
- blind flying instruments
- cathode ray tubes (aircraft systems)
- cockpit display devices
- cockpit voice recorders (aircraft)
- compasses
- control position indicators (aircraft)
- detecting devices (aircraft)
- display devices (aircraft)
- engine fuel quantity gages
- engine oil pressure gages
- engine oil temperature gages
- engine propulsion system instruments and gages
- engine RPM indicators
- fire control radar
- fire warning systems
- flight control computer systems
- flight instruments (aircraft)
- flight recorders (aircraft)
- fluid flow sensors (aircraft)
- gyroscopes (aircraft)
- heads-up displays (aircraft)
- horizon sensors (aircraft)
- infrared sensors (aircraft)
- instrument arrangement (aircraft)
- instrument design (aircraft)
- instrument displays (aircraft)
- instrument installation (aircraft)
- instrument landing systems (ILS)

- landing gear position indicators (aircraft)
- laser altimeters (aircraft)
- laser instruments (aircraft)
- Mach meters
- navigation instruments (design and development)
- onboard computer systems for aircraft
- pilot support systems (aircraft)
- position indicators (aircraft)
- power plant instruments and gages (aircraft)
- propulsion system instruments and gages (aircraft)
- rate of climb indicators
- recording devices (aircraft)
- sensors for aircraft equipment and operation
- skin temperature indicators (aircraft)
- stall indicators
- target acquisition
- target-signature modeling (aircraft)
- telemetry devices (aircraft)
- terrain clearance indicators
- turn and bank indicators
- warning systems (aircraft)

07 Aircraft Propulsion and Power

Includes primary propulsion systems and related systems and components, e.g., gas turbine engines, compressors, and fuel systems; and onboard auxiliary power plants for aircraft. For related information see also 20 Spacecraft Propulsion and Power; 28 Propellants and Fuels; and 44 Energy Production and Conversion.

Definition

Aircraft Propulsion – The action or process of imparting motion to an aircraft by means of a force such as a thrust of air or energy released by burning fuel. Adapted from the *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

Aircraft Power Supplies – Electric power sources for the normal operation of aircraft. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: All air-breathing engines and chemical, electric, hybrid, magnetohydrodynamic, or other types of energy conversion devices suitable for propulsion of aircraft or to provide a source of energy or power for the aircraft or its systems.

Selective Interest: Engines, rockets, and power conversion devices from other applications if readily convertible to aircraft use.

Negative Interest: Conventional, stationary power sources, and propulsion units for land and sea vehicles not modified for aircraft use.

Input Subjects of Specific Interest

- aerodynamic noise (propulsion systems)
- afterburner controls
- afterburners (aircraft engines)
- airbreathing engines (aircraft)
- aircraft engine design
- aircraft engine maintenance
- aircraft engine performance
- aircraft engine simulation
- aircraft engine testing
- aircraft engines
- aircraft fuel systems
- aircraft hydraulic systems (power)
- aircraft pneumatic systems (power)
- aircraft power systems
- aircraft propellers
- aircraft propulsion system components
- aircraft propulsion systems
- auxiliary power systems (aircraft)
- auxiliary power units (APU) (aircraft)
- bird ingestion (aircraft engines)
- bypass jet engines
- carburetors (aircraft engines)
- centrifugal compressors (aircraft)
- chemical propulsion engines (aircraft)
- combustors (aircraft)
- compression ignition engines (aircraft)
- compressors (aircraft engines)
- cooling systems (aircraft engines)
- diesel engines (aircraft)
- diffusers (aircraft engines)
- ejectors (aircraft)
- electric power systems (aircraft)

- electric power units (aircraft)
- electric propulsion systems (aircraft)
- engine control systems (aircraft)
- engine ingestion
- engine noise (aircraft)
- engine noise suppressors (aircraft)
- exhaust systems (aircraft engines)
- exit controls (aircraft engines)
- fan jet engines
- foreign object ingestion (aircraft engines)
- fuel distribution pumps (aircraft)
- fuel distribution systems (aircraft)
- fuel injection systems (aircraft)
- fuel system components (aircraft)
- fuel systems (aircraft)
- fuel tanks (aircraft)
- gas turbine engines (aircraft)
- gasoline engines (aircraft)
- injection systems (aircraft engines)
- inlet controls (aircraft engines)
- inlets (aircraft)
- internal combustion engines (aircraft)
- jet engines
- noise reduction (aircraft engines)
- nozzles (aircraft)
- nuclear engines (aircraft)
- nuclear propulsion systems (aircraft)
- piston engines (aircraft)
- pneumatic systems (aircraft propulsion and power)
- propellers (tractor, pusher, contrarotating, propfan)
- propulsion system components (aircraft)
- propulsion systems (aircraft)
- pulse detonation engines
- pulsejet engines
- pumps (aircraft engines and fuel systems)
- quiet engines (aircraft)
- ramjet engines (aircraft)
- reciprocating engines (aircraft)
- rocket engines (aircraft)
- rotary engines (aircraft)
- scramjet engines (aircraft)
- spark ignition engines (aircraft)
- Stirling cycle engines (aircraft)
- superchargers (aircraft engines)
- throttle controls (aircraft)
- thrust reverser controls
- thrust reversers (aircraft engines)
- turbine blade cooling
- turbine blade vibration
- turbines (aircraft engines)
- turbofan engines
- turboprop engines
- turborocket engines (aircraft)
- wind tunnel tests (propulsion systems)

08 Aircraft Stability and Control

Includes flight dynamics, aircraft handling qualities, piloting, flight controls, and autopilots. For related information see also 05 Aircraft Design, Testing and Performance; and 06 Avionics and Aircraft Instrumentation.

Definition

Aircraft Stability – The property of an aircraft to maintain its attitude or to resist displacement, and if displaced, to develop forces and moments tending to restore the original condition. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

Aircraft Control – To direct the movements of an aircraft with particular reference to changes in attitude and speed. Adapted from the *Dictionary of Technical Terms for Aerospace Use*. Wm. H. Allen, ed., 1965. NASA SP-7.

NASA Interest

Exhaustive Interest: Research, development, testing, evaluation, or performance topics related to the stability and control of any complete aircraft, or the interaction between the vehicle's components and the control of the aircraft in flight.

Selective Interest: Piloting as it affects the stability, control, and maneuverability of an aircraft.

Input Subjects of Specific Interest

- air launched weapons (stability)
- aircraft control
- aircraft stability
- aircraft trim
- attitude control (aircraft)
- automatic pilots (aircraft)
- body-tail combinations (stability and control)
- control effectiveness (aircraft)
- control surface interactions (aircraft)
- dutch roll
- dynamic stability (aircraft)
- flight control (aircraft)
- flight dynamics (aircraft)
- flight management systems
- flight path control (aircraft)
- flutter (aircraft)
- fly-by-light control (FBL)
- fly-by-wire control (FBW)
- flying qualities (aircraft)
- handling qualities (aircraft)
- lateral control (aircraft)
- lateral stability (aircraft)
- longitudinal control (aircraft)
- longitudinal stability (aircraft)
- maneuvering (aircraft)
- missiles (performance)
- operational effects of atmospheric variables
- pitch control (aircraft)
- pitch stability (aircraft)
- roll control (aircraft)
- roll stability (aircraft)
- spin recovery
- stability (aircraft)
- stability augmentation (aircraft)
- stability derivatives (aircraft)
- stabilization surfaces (aircraft)
- static stability (aircraft)

- vibration (aircraft)
- voice command for aircraft
- wind tunnel tests (stability and control)
- wing rock
- wing-body combinations (stability and control)
- wing-nacelle combinations (stability and control)
- yaw control (aircraft)
- yaw stability (aircraft)

09 Research and Support Facilities (Air)

Includes airports, runways, hangars, and aircraft repair and overhaul facilities; wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport ground equipment and systems. For airport ground operations see 03 Air Transportation and Safety. For astronautical facilities see 14 Ground Support Systems and Facilities (Space).

Definition

Facility – 1. A physical plant such as real estate and improvements thereto (including buildings and equipment) which provides the means of assisting or making easier the performance of a function. 2. Any part or adjunct of a physical plant, or any item of equipment which is an operating entity and which contributes or can contribute to the execution of a function by providing some specific kind of operating action or operation. *A Compendium of Authenticated Logistics Terms and Definitions*. Fred Gluck, ed. Department of the Air Force, 1970.

NASA Interest

Exhaustive Interest: All facilities and equipment associated with airports and airways; tracking and communications installations; and test facilities and simulators of direct interest to aeronautical activities, including wind tunnels, shock tubes, and test stands.

Selective Interest: Research, development, and test laboratories having potential interest to aeronautics activities; specialized equipment to generate unusual or extreme conditions of temperature, pressure, stress and strain, etc.

Negative Interest: Administrative and housekeeping functions at supporting facilities, commonly available off-the-shelf instrumentation and equipment systems, and commercial equipment not developed specifically for aeronautical use.

Input Subjects of Specific Interest

- aircraft ground handling equipment
- aircraft servicing equipment
- airport access
- airport lighting
- airport planning
- airports and airways
- altitude test facilities
- checkout facilities (aircraft)
- checkout systems (aircraft)
- clean rooms (aircraft manufacturing and test facilities)
- control towers
- crash test facilities
- development facilities (aircraft)
- engine test stands (aircraft)
- flight simulators (aircrew training and aircraft development)
- ground support equipment (aircraft)
- ground support facilities (aircraft)
- ground support systems (aircraft)
- ground support vehicles (aircraft)
- hangar facilities
- high temperature test facilities (aircraft)
- low temperature test facilities (aircraft)
- maintenance facilities (aircraft)
- overhaul facilities (aircraft)
- pressure test facilities (aircraft)
- repair facilities (aircraft)
- research facilities (aircraft)
- runway approach lighting and markers

- runway construction
- runway lighting
- runway surfaces and grooving
- runways
- shock tubes and tunnels
- simulators (aircraft)
- structures test facilities (aircraft)
- support facilities (aircraft)
- temperature test facilities (aircraft)
- test facilities (aircraft)
- tracking and communications installations (aircraft)
- wind tunnel test facilities (aircraft)

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and launch operations; space transportation and safety; space communications, spacecraft communications, command, and tracking; spacecraft design, testing and performance; spacecraft instrumentation and astrionics; and spacecraft propulsion and power. For related information see also AERONAUTICS (categories 01 through 09).

12 Astronautics (General)

Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms. For specific topics in astronautics see categories 13 through 20. For extraterrestrial exploration see 91 Lunar and Planetary Science and Exploration.

Definition

Astronautics – The science of space flight including the design, construction, and operation of spacecraft. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: Spacecraft production, manufacturing, and maintenance; space based manufacturing and maintenance; space colonization.

Negative Interest: Military or defense applications of launch vehicles and spacecraft.

Input Subjects of Specific Interest

- astronautics
- in-orbit maintenance, servicing and refueling
- launch vehicle maintenance
- launch vehicle manufacturing
- launch vehicle production
- maintenance (spacecraft)
- mission planning (space)
- space based maintenance and servicing;
- space colonies
- space colonization
- space exploration (mission planning)
- space manufacturing and assembly
- space programs
- space station assembly
- space station maintenance
- space vehicle maintenance
- space vehicle manufacturing
- space vehicle production
- spacecraft maintenance
- spacecraft manufacturing
- spacecraft production

13 Astrodynamics

Includes powered and free-flight trajectories; orbital and launching dynamics.

Definition

Astrodynamics – The practical application of celestial mechanics, astroballistics, propulsion theory, and allied fields to the problem of planning and directing the trajectories of space vehicles. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: Theoretical analysis and actual orbit and trajectories of launch vehicles and spacecraft.

Input Subjects of Specific Interest

- aerobraking
- astroballistics
- astrodynamics
- atmospheric entry effects
- ballistic trajectories
- free-flight trajectories
- gravitational effects (orbital effects on launch vehicles and spacecraft)
- interplanetary trajectories
- launch vehicle trajectories
- launching dynamics
- orbit dynamics of spacecraft
- orbital maneuvers (trajectories)
- orbital rendezvous
- powered trajectories
- projectile trajectories
- propulsion effects on launching, trajectories, and orbits
- reentry dynamics
- reentry trajectories
- space flight dynamics (theory)
- spacecraft orbits
- spacecraft trajectories
- swingby maneuver
- trajectory analysis
- trajectory optimization
- two-and three-body problems (trajectory analysis)

14 Ground Support Systems and Facilities (Space)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and test chambers and simulators. Also includes extraterrestrial bases and supporting equipment. For related information see also 09 Research and Support Facilities (Air).

Definition

Ground Support Systems and Facilities (Space) – That ground-based equipment, land, and buildings, including all implements, tools, and devices (mobile or fixed), required to inspect, test, adjust, calibrate, appraise, gage, measure, repair, overhaul, assemble, disassemble, transport, safeguard, record, store, or otherwise function in support of a rocket, space vehicle, or the like, either in the research and development, or in an operational phase, or in support of the guidance system used with the missile vehicle, or the like. Modified from the term Ground-Support Equipment. *Dictionary of Technical Terms for Aerospace Use*. Wm. H. Allen, ed., 1965. NASA SP-7.

NASA Interest

Exhaustive Interest: All information dealing with spaceports; launch towers; spacecraft and launch vehicle simulators; test facilities for spacecraft, launch vehicles and propulsion systems, and transporters; shuttlecraft landing facilities; ground-support equipment.

Selective Interest: Hangars, maintenance facilities, airports, airways, launch complexes, land transportation information that deals with transportation and safety to, from, and on launch complexes, and aerial navigation and tracking facilities when used in support of astronautical activities.

Negative Interest: Military mobile transporters and missile storage silos.

Input Subjects of Specific Interest

- accelerators (aerospace)
- assembly buildings
- astronaut training facilities
- automatic picture transmission (APT) ground stations
- block houses
- checkout facilities (space)
- checkout systems (space)
- clean rooms (space)
- deep space instrumentation facilities
- development facilities (space)
- electromagnetic launchers (facilities)
- engine test blocks (space)
- engine test stands (space)
- extraterrestrial bases
- flight simulators (space)
- gravity simulators
- ground support equipment (space)
- ground support facilities (space)
- ground support systems (space)
- ground support vehicles (space)
- high temperature test facilities (space)
- laser range finder facilities
- laser space communications facilities
- launch complexes
- launch facilities
- launch pads and bases
- launch towers
- launch vehicle simulators
- light gas guns (launch facilities)

- low temperature test facilities (space)
- lunar and planetary bases
- lunar facilities construction
- lunar gravity simulators
- lunar roving vehicles
- maintenance facilities (space based, ground based)
- mobile lunar laboratories
- mobile planetary laboratories
- mobile transporters
- optical tracking stations
- overhaul facilities (space)
- payload operations and support
- planetary roving vehicles
- pressure test facilities (space)
- rail accelerators, railguns, launchers (applications)
- range safety
- recovery equipment and vehicles
- remote launch monitoring facilities
- repair facilities (space based, ground based)
- research facilities (space)
- rocket engine test pads
- rocket sleds
- rocket test facilities
- rover vehicles
- shuttlecraft landing facilities
- simulators (space)
- solar heating simulators
- solar simulators
- space facility for cryogenic materials
- space research facilities
- space simulators
- space vacuum simulators
- spacecraft maintenance facilities
- spacecraft production facilities
- spacecraft simulators
- spaceport planning
- spaceports
- special vehicles (land, sea, air) (used as bases and for transportation or rescue of astronautics or astronautic-oriented equipment)
- storage facilities for propellants and cryogenics
- structures test facilities (space)
- support facilities
- surface exploration vehicles
- temperature test facilities (space)
- test facilities (space)
- test range facilities
- test ranges
- umbilical towers
- vacuum test facilities
- wind tunnel test facilities (launch and space vehicles)
- wind tunnel tests (launch and space vehicles)

15 Launch Vehicles and Launch Operations

Includes all classes of launch vehicles, launch/space vehicle systems, and boosters; and launch operations. For related information see also 18 Spacecraft Design, Testing, and Performance; and 20 Spacecraft Propulsion and Power.

Definition

Launch Vehicles – Rockets or other vehicles used to transport satellites, space probes, or other payloads from the Earth (or other terrestrial surface) to space. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration. *Dictionary of Technical Terms for Aerospace Use*. Wm. H. Allen, ed., 1965. NASA SP-7.

NASA Interest

Exhaustive Interest: Design, research, development, testing, evaluation, and performance of any launch vehicle, combination of launch vehicle and space vehicle, launch system components, and all operating procedures and problems related to launch vehicles.

Negative Interest: Design, performance, and effects of military weapons and warheads delivered by launch vehicle; pyrotechnic rockets used for displays and festivals.

Input Subjects of Specific Interest

- air launched vehicles
- boosters (launch vehicles)
- combinations of launch vehicles and space vehicles
- commercial launch vehicles
- countdown
- design of launch vehicles, tanks, components, systems
- electromagnetic launchers (operations)
- launch operations
- launch vehicle auxiliary systems
- launch vehicle configurations
- launch vehicle design
- launch vehicle dynamics
- launch vehicle performance
- launch vehicle preparation
- launch vehicle stability
- launch vehicle testing
- launch vehicles
- light gas guns (operations)
- multistage launch vehicles
- nose cones
- orbit-on-demand vehicles
- reentry launch vehicles
- reusable vehicles
- rocket launchers
- rockets
- satellite launching dynamics
- separation and staging techniques (for stages of launch vehicles)
- single-stage launch vehicles
- sounding rockets

16 Space Transportation and Safety

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information see also 03 Air Transportation and Safety; 15 Launch Vehicles and Launch Operations; and 18 Spacecraft Design, Testing and Performance. For space suits see 54 Man/System Technology and Life Support.

Definition

Space Transportation – The conveyance of payloads or personnel to, through, or from outer space. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: All information dealing with crew and payload space transportation; flight safety; rescue operations and techniques. Systems specific to ground operations, maintenance and support, and launch complex construction are covered in 14 Ground Support Systems and Facilities (Space).

Input Subjects of Specific Interest

- accidents and emergencies (spacecraft)
- cargo handling (spacecraft)
- cargo transportation (spacecraft)
- commercial spaceflight (operations)
- escape systems (spacecraft)
- explosions (spacecraft)
- extravehicular activity (EVA) (operations)
- fire (spacecraft)
- flight safety (spacecraft)
- orbiting maneuvering vehicles
- parachutes (spacecraft applications)
- passenger handling (space transportation)
- passenger transportation (space)
- Payload Assist Module (PAM) assist
- payload delivery (space transportation)
- payload handling (space transportation)
- payload retrieval (space transportation)
- recovery of spacecraft
- restraint harness (spacecraft)
- safety systems (spacecraft)
- search and rescue operations (space)
- shoulder harness (spacecraft)
- space debris (spaceflight hazard)
- space flight commercialization
- space flight hazards
- space operation emergencies
- space rescue
- space shuttle operations
- space transportation
- spacecraft ditching
- spacecraft health management
- spacecraft retrieval
- survival (space operations)

17 Space Communications, Spacecraft Communications, Command and Tracking

Includes space systems telemetry; space communications networks; astronavigation and guidance; and spacecraft radio blackout. For related information see also 04 Aircraft Communications and Navigation; and 32 Communications and Radar.

Definition

Space Communications – The act of, or methods for, conveying information to, from, or through outer space. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

Spacecraft Communications – The act of, or methods for, conveying information to or from manned or unmanned spacecraft. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

Spacecraft Command – All operations associated with the uplinking of instructions to a spacecraft in order to maintain or adjust the operational status of the spacecraft and its subsystems. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

Spacecraft Tracking – The process of following the movements of a spacecraft or space platform by radar, optical, or other means. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: All techniques, research, development, and application of methods, systems, and equipment intended for the transmittal of data to, or from, launch vehicles, space vehicles, communications and scientific satellites, and lunar and planetary bases; ground and space based tracking and data acquisition stations and systems; launch vehicle and space vehicle navigation and guidance.

Selective Interest: Communication and navigation techniques and theory of potential interest to space flight.

Negative Interest: Telephone, teletype, radio, radar, and microwave equipment and technology not having aerospace communication, command, or tracking applications.

Input Subjects of Specific Interest

- astronavigation
- automatic picture transmission (APT)
- celestial navigation (spacecraft)
- collision avoidance (spacecraft)
- command and control of spacecraft
- communications blackouts (reentry)
- communications networks (space)
- communications systems (space)
- Deep Space Network
- digital communications systems (spacecraft)
- global positioning systems (spacecraft)
- ground based data acquisition stations
- ground based data acquisition systems
- ground based tracking stations
- ground based tracking systems
- guidance system design (spacecraft)
- inertial navigation systems (spacecraft)
- inertial sensors and measurement units (spacecraft)
- laser communications systems (spacecraft)

- laser tracking systems (spacecraft)
- launch vehicle navigation
- man-machine communications (spacecraft)
- manned space flight network
- microwave communications systems (spacecraft)
- microwave receivers (spacecraft)
- microwave transmitters (spacecraft)
- navigation computer systems (spacecraft)
- navigation display devices (spacecraft)
- navigation system design (spacecraft)
- navigation systems (spacecraft)
- optical communication (space)
- orbital maneuvers (control)
- radar communications systems (spacecraft)
- radar detection (spacecraft navigation)
- radar imagery (spacecraft navigation)
- radar tracking systems (spacecraft)
- radio blackout (loss of communications)
- radio communications systems (spacecraft)
- range and angle measurement (spacecraft)
- rendezvous guidance
- search and rescue operations (communications)
- Shuttle Imaging radar (theory and techniques)
- space based data acquisition stations
- space based data acquisition systems
- space communications
- space communications networks
- space flight communication techniques and theory
- space flight navigation techniques and theory
- space navigation
- Space Tracking and Data Acquisition Network (STADAN)
- spacecraft command
- spacecraft communications
- spacecraft control (communications)
- spacecraft navigation
- spacecraft tracking
- speech analysis (spacecraft voice communications)
- speech compression (spacecraft voice communications)
- station keeping
- target-signature modeling (spacecraft)
- telemetry (spacecraft applications)
- tracking and communications installations (spacecraft)
- tracking networks
- tracking stations
- voice communications systems (spacecraft)
- wave propagation (spacecraft communications effect)

18 Spacecraft Design, Testing and Performance

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and spacecraft control and stability characteristics. For life support systems see 54 Man/System Technology and Life Support. For related information see also 05 Aircraft Design, Testing and Performance; 39 Structural Mechanics; and 16 Space Transportation and Safety.

Definition

Spacecraft Design – The act of conceiving and planning the structure, systems, and performance characteristics of any type of spacecraft including space probes, satellites, space platforms and space stations. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

Spacecraft Testing – Tests, by whatever means, of a spacecraft or any equipment, system, or component used in, or on, a spacecraft to determine its suitability for, and reliability in, space flight. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

Spacecraft Performance – The manner or effectiveness in which any space vehicle, space platform, or space station functions while in operation in space, or in a simulated space environment. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: Research, development, testing, evaluation, or performance of any complete spacecraft, system, or component; operating problems that affect or are affected by design, development, testing, evaluation, or performance.

Input Subjects of Specific Interest

- active communication satellite
- active satellite stabilization
- artificial satellites
- astronomical observatory satellites
- attitude control (spacecraft)
- automatic pilots (spacecraft)
- cabin pressurization (spacecraft)
- capture devices (spacecraft)
- communication satellites
- control effectiveness (spacecraft)
- control systems design (spacecraft)
- depressurization systems (spacecraft)
- docking (spacecraft)
- dynamic stability (spacecraft)
- expandable structures (spacecraft)
- fins (spacecraft)
- flight control (spacecraft)
- flight dynamics (spacecraft)
- flight path control (spacecraft)
- flutter (spacecraft)
- flying qualities (spacecraft)
- formation flying (satellites)
- free flyers (spacecraft)
- geophysical satellites
- handling qualities (spacecraft)
- hydraulic systems (spacecraft)
- inflatable structures (spacecraft)
- inlets (spacecraft)
- International Space Station (design)
- landing gear (spacecraft)
- LANDSAT (configurations)
- lateral control (spacecraft)

- lateral stability (spacecraft)
- longitudinal control (spacecraft)
- longitudinal stability (spacecraft)
- lunar landers
- lunar orbiters
- maneuvering (spacecraft)
- manned orbital laboratories
- manned spacecraft
- meteorite protection
- meteorological satellites
- models (spacecraft)
- navigation satellites
- observation satellites
- passive communication satellites
- passive satellite stabilization
- piloting (spacecraft)
- pitch control (spacecraft)
- pitch stability (spacecraft)
- planetary landers
- planetary orbiters
- planetary probes
- plasma wakes (spacecraft)
- pneumatic systems (spacecraft)
- pressurization systems (spacecraft)
- pressurized cabins (spacecraft)
- radiation effects on spacecraft and components
- reaction control systems (spacecraft)
- roll control (spacecraft)
- roll stability (spacecraft)
- satellite constellations
- satellite stabilization
- satellites for air, land, or sea navigation
- satellites for air, land, or sea traffic control
- scientific satellites
- search and rescue satellites
- SEASAT (configurations)
- separation and staging techniques (spacecraft)
- space flight dynamics (performance and testing)
- space laboratories
- space platforms
- space probes
- space station control
- space station design
- space stations
- spacecraft antennas
- spacecraft cabins
- spacecraft charging
- spacecraft components
- spacecraft control (design and performance)
- spacecraft design
- spacecraft environmental control
- spacecraft external contamination
- spacecraft flight simulation
- spacecraft flight tests
- spacecraft performance
- spacecraft simulation
- spacecraft structures
- spacecraft systems
- spacecraft testing
- spacecraft thermal control
- spacelab (design and testing)
- stability (spacecraft)
- stability augmentation (spacecraft)
- stability derivatives (spacecraft)
- stabilization surfaces (spacecraft)
- static stability (spacecraft)
- synchronous satellites
- tethered satellite systems
- thermal protection systems (spacecraft)
- tracking and data relay satellites
- unfoldable structures (spacecraft)
- vibration (spacecraft) (for effects on structural elements and fatigue see 39 Structural Mechanics)
- Viking space probe
- weather satellites
- wind tunnel tests (spacecraft)
- yaw control (spacecraft)
- yaw stability (spacecraft)

19 Spacecraft Instrumentation and Astrionics

Includes the design, manufacture, or use of devices for the purpose of measuring, detecting, controlling, computing, recording, or processing data related to the operation of space vehicles or platforms. For related information see also 06 Aircraft Instrumentation and Avionics; For spaceborne instruments not integral to the vehicle itself see 35 Instrumentation and Photography; For spaceborne telescopes and other astronomical instruments see 89 Astronomy.

Definition

Astrionics – Astronautical electronics, particularly the development and use of electronic equipment and systems for space vehicles and platforms.

Spacecraft Instrumentation – The design, development, installation, and use of electronic, optical, gyroscopic, and other instruments that play a role in the control of the spacecraft, or that function to measure, record, display, or process different values or quantities encountered in the flight of a spacecraft. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: Design, arrangement, installation, and use of devices for detecting, measuring, recording, telemetering, processing, or analyzing values or quantities characterizing an environment, spaceflight, launch vehicle, spacecraft, or other experimental phenomena encountered in launch vehicle and spacecraft flight.

Selective Interest: Instruments or displays and off-the-shelf equipment from other transportation media that could be transferred or modified for spacecraft or launch vehicle use.

Input Subjects of Specific Interest

- ablation sensors (spacecraft)
- alarm systems (spacecraft)
- altimeters (spacecraft)
- analyzing devices (spacecraft)
- astrionics
- attitude indicators (spacecraft)
- bioelectronic instruments (spacecraft)
- biomedical instruments (spacecraft)
- cabin display devices (spacecraft)
- cathode ray tubes (spacecraft systems)
- control position indicators (spacecraft)
- detecting devices (spacecraft)
- display devices (spacecraft)
- flight instruments (spacecraft)
- flight recorders (spacecraft)
- fluid flow sensors (spacecraft)
- gyroscopes (spacecraft)
- heads-up displays (spacecraft)
- horizon sensors (spacecraft)
- infrared sensors (spacecraft)
- instrument arrangement (spacecraft)
- instrument design (spacecraft)
- instrument displays (spacecraft)
- instrument installation (spacecraft)
- instrument pointing systems (IPS)
- landing gear position indicators (spacecraft)
- laser altimeters (spacecraft)
- laser instruments (spacecraft)
- micrometeoroid sensors (spacecraft)
- navigation display devices (design and development)
- onboard computer systems for spacecraft

- onboard instrument systems for spacecraft
- onboard sensors and recorders for spacecraft
- passive sensors, trackers, and references (spacecraft)
- pointing systems
- position indicators (spacecraft)
- propulsion system instruments and gages (spacecraft)
- recording devices (spacecraft)
- sensors for spacecraft equipment
- skin temperature indicators (spacecraft)
- space cabin atmosphere sensors
- spacecraft control computer systems
- spacecraft instruments
- spacecraft systems monitoring instruments
- star trackers (navigation)
- telemetry devices (spacecraft)
- thermal protection sensors
- two-gas sensors (spacecraft)
- warning lights (spacecraft)

20 Spacecraft Propulsion and Power

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information see also 07 Aircraft Propulsion and Power; 28 Propellants and Fuels; 15 Launch Vehicles and Launch Operations; and 44 Energy Production and Conversion.

Definition

Spacecraft Propulsion – The action or process of imparting motion to a spacecraft by means of a force such as a thrust of air or energy released by burning fuel. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

Spacecraft Power Supplies – Sources of electrical energy, including batteries, generators, and energy conversion devices, that support the normal operation of spacecraft. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: All chemical, electric, magnetohydrodynamic, hybrid, or other types of energy conversion suitable for propulsion or stationkeeping of spacecraft, satellites, space probes, planetary probes, space stations, and lunar probes; and for use as auxiliary power sources for spacecraft; including liquid rocket engines, solid rocket engines, ion engines, plasma rocket engines, electric rocket engines, etc., including their components.

Selective Interest: Propulsion and mobile or stationary power sources for earthbound use or transportation, e.g., ship, locomotive, automobile, aircraft, and truck propulsion; mobile or stationary electric power plants, unless directly applicable to spacecraft use.

Input Subjects of Specific Interest

- aerospike engines
- arcjet rocket engines
- attitude thrusters
- auxiliary power systems (spacecraft)
- auxiliary power units (APU) (spacecraft)
- boosters (spacecraft)
- chemical power sources (spacecraft)
- chemical propulsion engines (spacecraft)
- clustered rockets
- combustion chambers (spacecraft)
- combustors (spacecraft)
- ejectors (spacecraft)
- electric power systems (spacecraft)
- electric power units (spacecraft)
- electric propulsion systems (spacecraft)
- electric rocket engines
- electromagnetic propulsion (spacecraft)
- electrostatic rocket engines
- electrothermal rocket engines
- fuel distribution pumps (spacecraft)
- fuel distribution systems (spacecraft)
- fuel injection systems (spacecraft)
- fuel system components (spacecraft)
- fuel systems (spacecraft)
- fuel tanks (spacecraft)
- hybrid propellant rocket engines
- igniters (rocket engines)
- ion engines
- ion propulsion
- ion rocket engines
- laser propulsion
- liquid propellant rocket engines

- low thrust engines
- magnetic sails
- magnetohydrodynamic (MHO) power sources
- magnetohydrodynamic (MHO) thrusters
- main propulsion system components (spacecraft)
- main propulsion systems (spacecraft)
- multistage rockets
- nozzles (spacecraft)
- nuclear engines (spacecraft application)
- nuclear power sources (spacecraft application)
- nuclear propulsion systems (spacecraft application)
- nuclear rocket engines
- onboard solar arrays
- onboard solar generators
- plasma propulsion (spacecraft applications)
- pneumatic systems (spacecraft propulsion and power)
- propellant flow systems (spacecraft)
- propellant injectors, pumps, and tanks (spacecraft)
- propulsion system components (spacecraft)
- propulsion systems (spacecraft)
- pulsed plasma thrusters
- pumps (spacecraft)
- refueling in orbit
- resistojet rocket engines
- retrorockets
- rocket engine design
- rocket engine exhaust plumes
- rocket engine noise
- rocket engines (spacecraft)
- rocket throttling systems
- solar electric ion propulsion
- solar electric propulsion
- solar sails
- solid propellant rocket engines
- space power reactors (application)
- spacecraft auxiliary power sources
- spacecraft engine design
- spacecraft hydraulic systems (power)
- spacecraft pneumatic systems (power)
- spacecraft power systems
- spacecraft propulsion
- spacecraft vehicle booster engines
- systems for energy conversion (spacecraft)
- thrust chambers (rocket engines)
- thrust vector control devices (spacecraft)
- turborocket engines (spacecraft)
- vector control engines (spacecraft)
- vernier engines (spacecraft)

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic, organic and physical chemistry; metals and metallic materials; nonmetallic materials; propellants and fuels; and space processing.

23 Chemistry and Materials (General)

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics in chemistry and materials see categories 24 through 29. For astrochemistry see category 90 Astrophysics.

Definition

Chemistry – The science that studies the composition, structure, properties, interactions, and transformations of elemental matter and compounds. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

Materials – In general, the substances of which aircraft, launch vehicles, and space vehicles are composed; specifically, the metals, alloys, ceramics, and plastics used in structural, protective, and electronic functions. Adapted from the *Dictionary of Technical Terms for Aerospace Use*. Wm. H. Allen, ed., 1965. NASA SP-7.

NASA Interest

Exhaustive Interest: Properties, composition, structure, synthesis, and manufacture of compounds and materials used for aircraft, launch and space vehicles, launch site equipment, space structures, and other aerospace applications.

Selective Interest: Studies of chemistry or materials having no aerospace applications.

Input Subjects of Specific Interest

- chemical analysis techniques
- chemical manufacturing
- chemical processing (general)
- chemistry (general)
- materials (general)
- separations chemistry
- spectroscopic analysis (chemistry)

24 Composite Materials

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

Definition

Composite Materials – Structural materials of metals, ceramics, or plastics with built-in strengthening agents which may be in the form of filaments, foils, powders, or flakes of a different compatible material. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration. *Dictionary of Technical Terms for Aerospace Use*. Wm. H. Allen, ed., 1965. NASA SP-7.

NASA Interest

Exhaustive Interest: Physical and mechanical properties, production, handling, testing, and evaluation of composite materials for use in aircraft, rockets, launch vehicles, space vehicles, reentry vehicles, aircraft and spacecraft propulsion systems, and supporting facilities.

Selective Interest: Research and development on composite materials having potential aerospace applications.

Negative Interest: Routine developments of structural composite materials for use in housing, heavy industry, and earthbound transportation, unless a potential exists for aerospace use.

Input Subjects of Specific Interest

- ablative materials (composite)
- boron fiber materials
- carbon fiber materials
- ceramic matrix composites
- composite materials
- epoxy matrix composites
- fatigue (composite materials)
- fiber composites
- fiber-matrix interfaces
- filament materials
- filament wound structures (composite materials)
- filament-matrix materials
- flammability (composite materials)
- glass fiber reinforced plastics
- honeycomb materials
- insulation (composite materials)
- laminates
- mechanical properties (composite materials)
- metal filament systems
- metal matrix composites (MMC)
- nanocomposites
- offgassing/outgassing (composite materials)
- polymer matrix composites
- reinforcing fibers (composite materials)
- shear strength (composite materials)
- stacking sequence (composite materials)
- surface properties (composite materials)
- tensile strength (composite materials)
- testing of materials (composite materials)
- whisker composites
- whiskers (composite materials)
- woven composites

25 Inorganic, Organic and Physical Chemistry

Includes the analysis, synthesis, and use inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see category 34 Fluid Dynamics and Thermodynamics. For astrochemistry see category 90 Astrophysics.

Definition

Inorganic Chemistry – The study of the composition, properties, structure, and reactions of the chemical elements and all their compounds with the exception of hydrocarbons and their derivatives. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

Organic Chemistry – The study of the composition, properties, structure, and reactions of carbon-based compounds, specifically hydrocarbons and their derivatives and normally excluding carbon oxides, metallic carbonates, carbides, and carbon-sulfur and carbon-nitrogen compounds. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

Physical Chemistry – The application of the laws, principles, and techniques of physics to the study of chemical properties, transformations, and reactions. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space administration.

NASA Interest

Exhaustive Interest: Chemistry of elements and compounds characteristic of NASA's aerospace, planetary, and astronomical interests; combustion theory and processes of direct relevance to aircraft, launch vehicle, and spacecraft materials and propulsion; and low pressure and vacuum reactions.

Negative Interest: Chemical research of elements, processes, and compounds that do not have possible aerospace applications.

Input Subjects of Specific Interest

- alkali metal vapors
- analytical chemistry
- catalysts (chemical)
- chemical analysis
- chemical engineering
- chemiluminescence
- chemistry of compounds
- chemistry of elements
- chromatography (application)
- combustion chemistry
- combustion kinetics
- combustion physics
- combustion processes
- combustion theory
- detonation processes
- electrochemical processes
- electrochemistry
- electrophoresis
- ferromagnetic resonance
- flame studies
- flammability
- gas absorption
- gaseous reactions
- gas-solid reactions
- gas-surface interactions
- gas-surface reactions

- ignition studies
- infrared gas analysis
- inorganic chemistry
- low pressure chemistry
- luminescence (chemistry)
- mass spectroscopy (application)
- organic chemistry
- organometallic materials
- osmosis (chemistry)
- photochemistry
- physical chemistry
- polarography (application)
- pyrolysis
- radiation chemistry
- spectrophotometry (application)
- spectroscopic chemical analysis (application)
- thermochemistry
- vacuum chemistry

26 Metals and Metallic Materials

Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.

Definition

Metallic Materials – Materials that are like metal; having the properties of metal; containing or consisting of metal.

NASA Interest

Exhaustive Interest: Physical, chemical, and mechanical properties; testing, evaluation, and protection of metals, alloys, and related compositions for use in aircraft, rockets, launch vehicles, space vehicles, reentry vehicles, aircraft and spacecraft propulsion systems, and supporting facilities (other than conventional building structural materials).

Selective Interest: Research and development on metallic materials that have potential aerospace applications.

Negative Interest: Routine developments of structural metallic materials for use in housing, heavy industry, and earthbound transportation, unless a potential exists for aerospace use.

Input Subjects of Specific Interest

- alloys
- anodizing
- cermets
- chemical properties of alloys
- chemical properties of metals
- compression strength (metallic materials)
- corrosion
- creep strength (metallic materials)
- crystal structure (metallic materials)
- crystals (metallic)
- development of alloys
- eutectics
- eutectoids
- evaluation of alloys
- evaluation of metals
- fatigue (metallic materials)
- ferrites
- fibers (metallic materials)
- flammability (metallic materials)
- heat treatment of metals
- hydrogen embrittlement
- intermetallics
- mechanical properties of alloys
- mechanical properties of metals
- metal crystals
- metallic fibers
- metallic materials
- metallography
- metallurgy
- metals
- microstructure of welded joints
- offgassing/outgassing (metallic materials)
- packing (metallic materials)
- phase equilibrium
- physical properties of alloys
- physical properties of metals
- powder metallurgy
- protection of alloys
- protection of materials (metallic)
- protective coatings (metallic materials)
- refractory materials

- reinforcing filaments (metallic materials)
- research on metallic materials
- sealants (metallic materials)
- shear strength (metallic materials)
- sintering (metallic materials)
- stress corrosion cracking
- surface hardening of metals
- surface properties (metallic materials)
- tensile strength (metallic materials)
- testing of alloys
- testing of materials (metallic materials)
- vacuum arc melting
- welded joints (microstructure)
- whiskers (metallic materials)

27 Nonmetallic Materials

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see 24 Composite Materials.

Definition

Nonmetallic Materials – Materials that do not have the properties of, or do not contain, metal and that are able to combine with hydrogen to form stable compounds, acids, acidic oxides, and anions.

NASA Interest

Exhaustive Interest: Physical, chemical, and mechanical properties; testing, evaluation, and protection of nonmetallic materials (other than conventional building structural materials).

Selective Interest: Research and development on nonmetallic materials that have potential aerospace applications.

Negative Interest: Routine developments of structural nonmetallic materials for use in housing, heavy industry, and earthbound transportation, unless a potential exists for aerospace use.

Input Subjects of Specific Interest

- ablative materials (nonmetallic)
- adhesives
- carbon nanotubes (synthesis and properties)
- cements
- ceramic materials
- chemical properties of nonmetallic materials
- cleaners
- compression strength (nonmetallic materials)
- creep strength (nonmetallic materials)
- crystal structure (nonmetallic materials)
- crystals (nonmetallic)
- development of nonmetallic materials
- elastomers
- evaluation of nonmetallic materials
- fabrics (nonmetallic materials)
- fatigue (nonmetallic materials)
- ferrofluids
- fibers (nonmetallic materials)
- film strength
- flammability (nonmetallic materials)
- foam materials
- glass materials
- glues
- graphite
- greases
- hydraulic fluids
- hydrogels
- insulation (nonmetallic materials)
- lubricants
- lubrication properties of nonmetallic materials
- mechanical properties of nonmetallic materials
- nonmetallic fibers
- nonmetallic materials
- offgassing/outgassing (nonmetallic materials)
- packing (nonmetallic materials)
- paints
- paper
- patching compounds
- physical properties of nonmetallic materials
- plastics
- plywoods
- polymers

- protection of materials (nonmetallic)
- protective coatings (nonmetallic)
- radomes (nonmetallic materials)
- reinforcing filaments (nonmetallic)
- research on nonmetallic materials
- rubber
- sealants (nonmetallic materials)
- sheer strength (nonmetallic materials)
- silicon materials
- solvents
- surface properties (nonmetallic materials)
- tensile strength (nonmetallic materials)
- testing of materials (nonmetallic)
- textiles
- whiskers (nonmetallic materials)
- woods

28 Propellants and Fuels

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see 73 Nuclear Physics. For related information see also 07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power; and 44 Energy Production and Conversion.

Definition

Propellants – Any agent used for consumption or combustion in rockets and from which the rockets derive their thrust such as fuels, oxidizers, additives, catalysts, or any compounds or mixtures of these. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

Fuels – Any substance used to produce heat, either by chemical or nuclear reaction, as used, e.g., in a heat engine. *NASA Aeronautical Dictionary*. Frank Davis Adams, ed., 1959.

NASA Interest

Exhaustive Interest: Physical, chemical, and mechanical properties; testing, evaluation, storage and handling procedures of rocket propellants and aircraft fuels. For facilities to store or handle fuels or propellants see 09 Research and Support Facilities (Air); and 14 Ground Support Systems and Facilities (Space).

Selective Interest: Research and development of fuels and propellants for earthbound transportation systems and power production that have potential aerospace applications.

Negative Interest: Routine developments of fuels for marine, automotive, home heating, heavy industry, and other earthbound applications.

Input Subjects of Specific Interest

- aircraft fuels
- boiloff
- boron-based fuels
- burning rates
- catalysts (propellants)
- chemical properties of propellants and fuels
- combustion characteristics (propellants and fuels)
- combustion controllability (propellants and fuels)
- combustion in microgravity (propellants and fuels)
- combustion instability (propellants and fuels)
- combustion kinetics (propellants and fuels)
- combustion of propellants and fuels
- combustion products
- cryogenic propellants
- decomposition (propellants and fuels)
- development of propellants and fuels
- evaluation of propellants and fuels
- exotic propellants and fuels
- explosives
- flames and flame propagation (propellants and fuels)
- fluorine/oxygen propellants
- fuels
- gelled propellants and fuels
- handling of propellants and fuels
- high energy propellants and fuels
- hybrid propellants and fuels
- hydrazine propellants
- hydrides
- hydrogen propellants and fuels
- hypergolic propellants

- igniters (propellants)
- ignition studies (propellants and fuels)
- jet engine fuels
- kerosene based fuels
- liquid fuels
- liquid hydrogen (propellants and fuels)
- liquid oxygen (propellants and fuels)
- liquid petroleum gas (LPG)
- liquid propellants
- lithergolic propellants
- manufacture of propellants
- mechanical properties of propellants and fuels
- metal based propellants and fuels
- monopropellants
- nitrate based propellants and fuels
- oxidizers
- physical properties of propellants and fuels
- piston engine fuels
- propellant grains
- propellant storage
- propellants
- pyrotechnics
- rocket propellants
- service life of propellants and fuels
- solid propellant curing
- solid propellants
- space storable propellants
- storage of propellants and fuels
- testing of propellants and fuels
- thermal characteristics
- thixotropic propellants
- vaporization of propellants and fuels

29 Space Processing

Includes space-based development of materials, compounds, and processes for research or commercial application. Also includes the development of materials and compounds in simulated reduced-gravity environments. For legal aspects of space commercialization see 84 Law, Political Science and Space Policy.

Definition

Space Processing – Synthesis, processing, forming, and fabrication of compounds or materials in space or in a simulated space environment; normally involving techniques that exploit low-gravity or high-vacuum conditions.

NASA Interest

Exhaustive Interest: All aspects of space processing including the effects of space or simulated space environments on the chemical, structural, and physical properties of materials and compounds as related to manufacturing or processing in space.

Input Subjects of Specific Interest

- alloy formation (space processing)
- biological materials (space processing)
- composite material formation (space processing)
- containerless processing
- crystal growth (space processing)
- electrophoresis operations in space (EOS)
- fluids behavior (space processing)
- glass formation (space processing)
- macromolecular crystallography (space processing)
- materials processing in space
- materials separation in space
- microgravity (space processing)
- multiphase materials processing in space
- pharmaceutical preparation (space processing)
- polymers (space processing)
- reduced gravity effects (materials)
- space based equipment for space processing
- space commercialization (space processing)
- space processing of materials

ENGINEERING

Includes engineering (general); communications and radar; electronics and electrical engineering; fluid mechanics and thermodynamics; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics. For related information see also PHYSICS (categories 70 through 77).

31 Engineering (General)

Includes general research topics related to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see categories 32 through 39.

Definition

Engineering – The useful application of scientific or other systematic knowledge of the properties of matter and the sources of energy in nature. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: Vacuum technology; aerospace safety engineering; control and display technology; cryogenics.

Selective Interest: Computer aided manufacturing; air cushion vehicle technology; applied mechanics; engineering with potential aerospace application.

Negative Interest: Engineering technology with no aerospace applications.

Input Subjects of Specific Interest

- applied mechanics
- civil engineering
- computer aided manufacturing (CAM) (Engineering)
- cryogenics
- display engineering
- engineering (general)
- fire prevention
- industrial process control
- industrial safety procedures
- liquefied gases
- metrication
- metrology
- safety procedures (engineering)
- vacuum technology

32 Communications and Radar

Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 Aircraft Communications and Navigation; and 17 Space Communications, Spacecraft Communications, Command and Tracking; for search and rescue, see 03 Air Transportation and Safety; and 16 Space Transportation and Safety.

Definition

Communications – A field of specialization covering radio, optical, and wire transmission and receipt of information, and related electronic devices and their uses. Adapted from the *United States Air Force Dictionary*. Woodford Agee Heflin, ed. Princeton, NJ: D. Van Nostrand, Co., Inc.

Radar – Radio detection and ranging, i.e., a method, system or technique of using beamed, reflected and timed radio waves for detecting, locating or tracking objects (such as rockets), for measuring altitude, etc., in any of various activities, such as air traffic control or guidance. The electronic equipment or apparatus used to generate, transmit, receive, and usually, to display radio scanning or locating waves; a radar set. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration. *Dictionary of Technical Terms for Aerospace Use*. Wm. H. Allen, ed., 1965. NASA SP-7.

NASA Interest

Exhaustive Interest: All equipment, techniques, and applications specifically intended for the transmittal of data, voice communications, code, or other intelligence to, from, or between aircraft, scientific and communications satellites, launch vehicles, manned or unmanned spacecraft, lunar and planetary bases; ground based tracking and communication stations; tracking and data acquisition networks; telemetry theory and techniques related to aerospace experiments.

Selective Interest: Earthbased communications techniques and theory of potential interest for aerospace applications.

Negative Interest: Commercial telephone, teletype, television, and radio operations unless directly related to aerospace communications; courier and messenger service.

Input Subjects of Specific Interest

- antenna design
- antenna radiation patterns
- antenna theory
- communications (general)
- communications blackouts (electromagnetic interference)
- communications coding
- communications equipment
- communications interference
- communications networks (theory and techniques)
- communications noise
- communications satellite operational problems
- communications systems (theory and techniques)
- communications techniques
- communications theory
- data transmission applications
- data transmission development
- data transmission equipment
- data transmission research
- data transmission techniques

- digital communications systems (theory and techniques)
- electromagnetic interference
- electromagnetic radiation (communications)
- electromagnetic wave propagation
- electronic countermeasures
- frequency assignment
- global communications
- ionospheric effects on radio transmission (communications)
- ionospheric propagation (communications)
- ionospheric scatter (communications)
- ladar (application)
- large deployable space antennas
- laser communications
- laser optical radar
- lidar
- man-machine communications (theory and techniques)
- microwave communications systems (applications)
- microwave radiation (properties)
- microwave receivers (theory and techniques)
- microwave techniques
- microwave theory
- microwave transmitters (theory and techniques)
- modulation (signals)
- networks (communications)
- optical communications (applications)
- phase shift keying (PSK)
- phased array radar
- radar (theory and techniques)
- radar absorbing materials
- radar antenna design
- radar antennas (theory and techniques)
- radar clutter
- radar communications systems (theory and techniques)
- radar detection (communications)
- radar imagery (communications)
- radar receivers (theory and techniques)
- radar scattering
- radar tracking systems (theory and techniques)
- radar transmitters (theory and techniques)
- radio (theory and techniques)
- radio antenna design
- radio antennas (theory and techniques)
- radio communication systems (theory and techniques)
- radomes (design)
- satellite communications (earth communications)
- satellite networks (earth communications)
- side looking radar (theory and techniques)
- signal analyzers
- signal decoding
- signal detection
- signal encoding
- signal generators (theory and techniques)
- signal modulators
- signal processing
- speech analysis (electromagnetic aspects)
- speech data compression (communications)
- synthetic aperture radar
- telemetry (theory and techniques)
- television systems (aerospace applications)
- transmitters (theory and techniques)
- tropospheric scatter (electromagnetic effects)
- voice communications
- wave propagation (electromagnetic)
- whistlers (electromagnetic)

33 Electronics and Electrical Engineering

Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment; and microelectronics and integrated circuitry. For related information see also 60 Computer Operations and Hardware; and 76 Solid-State Physics. For communications equipment and devices see 32 Communications and Radar.

Definition

Electronics – Study and application of the motions of electrons through vacuum or gaseous, conducting, or semiconducting media. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

Electrical Engineering – Branch of engineering related to the design, development, and operation of electrical devices and systems. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: Theory, development, design, testing, performance, and operations of electric components, devices, and circuitry that have direct application in aircraft, launch vehicles, space vehicles, and their components and equipment; launch, research, and testing facilities, and the electric components and equipment used in these.

Selective Interest: Theory, research, development, design, testing, performance, and operation of electric equipment, components, devices, and circuitry having potential applications for aerospace use, or for use under extreme or unusual conditions or environments.

Negative Interest: Research, development, design, testing, performance, and operation of components, devices, and circuitry of electronic-electrical equipment for commercial nonaerospace applications.

Input Subjects of Specific Interest

- amplifiers
- audio amplifiers
- batteries (electrical design)
- bridge circuits
- capacitors
- cathode ray tubes (electrical design)
- charge-coupled devices
- chips (integrated circuits)
- chokes (electric, electronic)
- circuit simulation (integrated circuits)
- circuit theory
- converters
- crystals (electronic applications)
- dielectrics (electronic application)
- diodes
- dividers (electric)
- electric circuits
- electric filters
- electric motors
- electric power units (electrical design)
- electrical components
- electrical engineering
- electrical relays
- electromechanics
- electron beam devices
- electron tubes
- electronic circuits
- electronic components

- electronic packaging
- electronic test equipment
- electronics
- field effect transistors (FET)
- field programmable gate arrays
- filters (electric, electronic)
- fuses (electric)
- generators (electrical design)
- inductors (electric)
- insulation (electric, electronic)
- integrated circuits
- inverters
- Kalman filters
- klystrons
- light emitting diodes (LED)
- lithography (circuit fabrication)
- magnets (electrical, electronics application)
- microcircuits
- microelectronics
- microminiaturization
- modulators (electric, electronic devices)
- nanodevices (electronic)
- networks (circuitry)
- opto-acoustic electronics
- optoelectronics (applications)
- oscillators
- photoelectric devices
- photomultipliers
- power amplifiers
- power packs (electric)
- power supplies electric)
- printed circuits
- programmable logic devices
- radomes (electrical properties)
- rail accelerators, railguns, launchers (theory)
- reconfigurable hardware
- rectifiers
- regulators (voltage, current)
- resistors
- semiconductor devices
- servomechanisms (electrical aspects)
- signal generators (applications)
- silicon cells (electrical properties)
- single event transients
- single event upsets
- sneak circuit analysis
- solar cells (electrical design)
- solar state circuitry
- solid state devices
- superconductivity (applications)
- surface wave acoustic devices (electronic design)
- switches
- switching circuits
- switching theory
- test equipment (electrical properties)
- thyratrons
- transducers
- transformers
- transistors
- transmission lines
- traveling wave tubes
- triodes
- tunnel diodes
- vacuum tubes
- very large scale integration (VLSI)
- VHSIC
- waveguides

34 Fluid Mechanics and Thermodynamics

Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also 02 Aerodynamics.

Definition

Fluid Mechanics – The experimental and mathematical study of the mechanical properties of gases and liquids at rest and in motion. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

Heat Transfer – The transfer or exchange of heat by radiation, conduction, or convection within a substance and between the substance and its surroundings. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration. *Dictionary of Technical Terms for Aerospace Use*. Wm. H. Allen, ed., 1965. NASA SP-7.

Thermodynamics – Study and application of principles describing the relation of heat transfer to various forms of energy, and the behaviors of physical systems where temperature is a significant feature. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: Theories, research, and studies on the forces, flow, mechanical properties and heat transfer of liquids or gases having specific relevance to aerospace interests or under conditions encountered in aircraft, spacecraft, launch vehicles, space vehicles, propulsion systems, or support facilities. Theory, research, and development on heat transfer of relevance also to the thermodynamic properties of elements, compounds, materials, and substances found in aerospace science and technology. (Those subjects concerned with astronomical, solar, and stellar phenomena and their interactions should be included in 89 Astronomy; or 90 Astrophysics.)

Selective Interest: Research developments, and studies of liquids and gases and heat transfer of potential interest for aerospace applications or under unusual or extreme conditions.

Negative Interest: Heat transfer and flow of liquids and gases over wires, through channels, ducts, and pipes related to normal powerplant, reservoir, irrigation, and residential-business use unless related to remote sensing, Earth resources, or for other potential aerospace application.

Input Subjects of Specific Interest

- ablation
- ablation cooling
- atomizers
- boiling
- Boltzmann transport theory
- boundary layer flow (general)
- cavitation
- compressible flow (general)
- computational fluid dynamics
- convection
- enthalpy
- entropy
- equations of state
- flow (general)
- flow characteristics
- flow equations
- flow measurement
- flow visualization (general applications)

- flow with heat addition
- fluerics
- fluid dynamics
- fluid flow
- fluid forces
- fluid heat transfer
- fluid kinematics
- fluid mechanics
- fluidics
- free energy
- gas dynamics
- gas flow
- gas forces
- gas heat transfer
- gas mechanics
- gaseous film cooling
- heat exchangers (aerospace applications)
- heat pipes (aerospace applications)
- heat shields (aerospace applications)
- heat sinks (aerospace applications)
- heat transfer
- hydraulics
- hydrodynamics
- hydrostatics
- incompressible flow
- induction heating
- internal flow in ducts (applications)
- internal flow in turbomachinery (applications)
- inviscid flow
- laminar flow (general)
- liquid settling
- liquid sloshing
- mass transfer
- mixing of gases
- mixing of liquids
- multiphase flow
- Navier-Stokes equations
- pneumatics
- radiative transfer
- radiators (aerospace applications)
- rheology
- shear flow
- shear thinning
- shock waves
- skin friction
- sprays
- temperature-pressure phenomena
- thermal radiation
- thermodynamic cycles
- thermodynamic properties
- thermodynamics
- transitional flow (general)
- transpiration cooling
- turbulence models
- turbulent flow (general)
- unsteady flow (general)
- viscous flow
- vortices (general)

35 Instrumentation and Photography

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography. For aerial photography see 43 Earth Resources and Remote Sensing. For related information see also 06 Avionics and Aircraft Instrumentation; and 19 Spacecraft Instrumentation.

Definition

Instrumentation – The design, assemblage, arrangement, installation, and use of devices for controlling, detecting, measuring, recording, or displaying data; or supporting devices for transmitting, processing, or analyzing data. Adapted from the *Dictionary of Technical Terms for Aerospace Use*. Wm. H. Allen, ed., 1965. NASA SP-7.

Photography – A process for recording visual images by exposing a light-sensitive substance to radiation such as visible light, infrared radiation, or x-rays. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: Design, development, installation, and use of devices for detecting, measuring, recording, telemetering, processing, or analyzing values or quantities related to aeronautical or space flight; the environment within or outside the flight vehicle; the physical operation and well being of the flight vehicle and its structure during all phases of flight; the facilities for testing and/or developing the flight vehicle; the observations and experiments performed as a result of the flight of these vehicles.

Selective Interest: Instrument design, development, and theory for other purposes that have potential aerospace applications because of advanced or unusual features, or are developed for extreme environments or unusual test conditions.

Negative Interest: Commercial off-the-shelf photographic equipment and instrument design and development for general use for artistic or commercial applications.

Input Subjects of Specific Interest

- ablation sensors (design and techniques)
- accelerometers
- alarm systems (design and techniques)
- analyzing devices (design and techniques)
- anemometers (design and techniques)
- atomic clocks (design and techniques)
- attitude indicators (design and techniques)
- bioelectronic instruments (theory and techniques)
- bioinstrumentation (theory and techniques)
- biomedical instruments (theory and techniques)
- Bragg cells (design and techniques)
- cameras
- coronagraphs
- darkroom equipment
- detectors
- Earth sensors
- electron microscopes
- electro-optical systems (instrumentation)
- emissivity measurements
- filters (photographic)
- flow visualization (instrumentation)
- fluid flow sensors (general)

- gages (general)
- geophysical sensors (design and techniques)
- gyroscopes (design and operation)
- holography
- image enhancement
- infrared sensors
- instrument design (theory and techniques)
- instrumentation
- interferometers
- ion mass spectrometers
- laser Doppler velocimeters
- laser instruments (design and operation)
- lenses (photographic)
- mass spectrometers
- measuring instruments
- micrometeoroid sensors (instrumentation)
- microscopes
- multimode sensors
- multispectral sensors
- nondestructive testing instruments
- optical imaging devices (design and techniques)
- optical measuring instruments (design and techniques)
- oscilloscopes
- ozonesondes
- photographic processing equipment
- photographic supplies
- photography
- photometry
- phototheodolites
- physiological monitoring devices (theory and techniques)
- position sensors
- precision time and time interval (PTTI)
- pressure transducers
- radiation instruments
- radiography
- recording devices
- remote sensors
- scatterometers (design and techniques)
- sensors
- shock tube instruments
- spectral analysis instruments
- spectrometers
- spectrophotometers
- spectroscopes
- strain gags
- tape recorders
- temperature measuring instruments
- test facility instruments
- thermocouples (design and techniques)
- time measurement equipment
- tomography (design and techniques)
- transducers (applications)
- two-gas sensors (general)
- ultrasonic testing equipment
- vidicon cameras
- wind tunnel instruments

36 Lasers and Masers

Includes lasing theory, laser pumping techniques, maser amplifiers, laser materials, and the assessment of laser and maser outputs. For cases where the application of the laser or maser is emphasized see also the specific category where the application is treated. For related information see also 76 Solid-State Physics.

Definition

Lasers – Devices for producing light by emission of energy stored in a molecular or atomic system when stimulated by light or an electric discharge. (From Light Amplification by Stimulated Emission of Radiation.). *Dictionary of Technical Terms for Aerospace Use*. Wm. H. Allen, ed., 1965. NASA SP-7.

Masers – Amplifiers or oscillators utilizing the principle of microwave amplification by stimulated emission of radiation. Adapted from the *Dictionary of Technical Terms for Aerospace Use*. Wm. H. Allen, ed., 1965. NASA SP-7.

NASA Interest

Exhaustive Interest: Fundamental research, theory, and development of lasers and masers with particular or potential aerospace application to drilling and welding of materials, electronic devices, space communications, tracking, navigation, and optical radar.

Negative Interest: Laser medical and surgical use unless related to specific aerospace disorders.

Input Subjects of Specific Interest

- chemical lasers
- dye lasers
- gas lasers
- glass lasers
- ladar (design)
- laser amplifiers
- laser Applications
- laser beams
- laser cavities
- laser damage
- laser drilling (theory and techniques)
- laser materials
- laser modulators
- laser optics
- laser radiation effects
- laser radiation hazards
- laser research
- laser theory
- laser tracking systems (general)
- lasers
- lasertrons
- liquid lasers
- masers
- orotrons
- parametric amplifiers
- quantum generators
- semiconductor lasers
- short pulsed lasers
- solid state lasers
- tunable lasers

37 Mechanical Engineering

Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see 63 Cybernetics, Artificial Intelligence, and Robotics; and 54 Man/System Technology and Life Support.

Definition

Mechanical Engineering – Branch of engineering dealing with the design, development and operation of machines including mechanical devices and prime movers, vehicles, machine tools, and manufacturing machinery. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: Design, development, and testing of all mechanical devices, equipment, and systems that are applied to launch vehicles, spacecraft, space stations, or aerospace support equipment.

Selective Interest: Potential aerospace applications of machine elements and processes, manufacturing processes, nonpower auxiliary systems, and equipment.

Input Subjects of Specific Interest

- airbreathing engines (non-aircraft)
- auxiliary systems (mechanical)
- bearings
- bonding
- Brayton cycle turbines (mechanical engineering)
- brazing
- cams
- centrifugal compressors (non-aircraft)
- centrifugal pumps
- ceramic engines
- cladding
- clutches
- coatings
- compression ignition engines (non-aircraft)
- containers
- dies
- diesel engines (non-aircraft)
- drives
- electrodeposition
- electron beam welding
- electroplating
- fasteners
- filters (mechanical)
- fittings
- fixtures
- flywheels
- friction measurement
- friction phenomena
- friction stir welding
- friction welding
- gaskets
- gasoline engines (non-aircraft)
- gears
- grinding
- heat pumps
- heating, ventilation, and air conditioning (HVAC)
- hydraulic systems (general)
- impact phenomena
- impact testing
- internal combustion engines (non-aircraft)
- joining
- laser welding

- lubrication
- machine elements
- machine processes
- machinery
- machining
- manufacturing processes
- materials fabrication
- materials forming
- materials handling
- materials manufacturing
- mechanical engineering
- mechanical equipment
- mechanics (practical)
- metal forming
- micromachining
- mounts (supports)
- nanodevices (mechanical)
- packaging
- packing (machine elements)
- piston engines (non-aircraft)
- plasma spraying
- plating
- pneumatic systems (general)
- powertrains
- pressure vessels
- pumps (non-aircraft)
- reaction wheels
- reciprocating engines (non-aircraft)
- refrigeration
- robotics (hardware)
- rollers
- rotary engines (non-aircraft)
- seals (stoppers)
- servomechanisms (mechanical aspects)
- shafts (machine elements)
- spark ignition engines (non-aircraft)
- springs (mechanical)
- Stirling cycle engines (non-aircraft)
- throttle controls (non-aircraft)
- tools
- tribology
- turbine engines (non-aircraft)
- vacuum forming
- valves
- welding techniques

38 Quality Assurance and Reliability

Includes approaches to, and methods for reliability analysis and control, quality control, inspection, maintainability, and standardization.

Definition

Quality Assurance – A system of activities whose purpose is to provide assurance and show evidence that the overall quality control task is in fact being done effectively. The system involves a continuing evaluation of the adequacy and effectiveness of the overall quality control program with a view to having corrective measures initiated where necessary. *AGARD Multilingual Aeronautical Dictionary*, 1980.

Reliability – Of a piece of equipment or a system, the probability of specified performance for a given period of time when used in the specified manner. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration. *Dictionary of Technical Terms for Aerospace Use*. Wm. H. Allen, ed., 1965. NASA SP-7.

NASA Interest

Exhaustive Interest: Quality control, quality assurance, and reliability theories, procedures, and practices specifically applicable to aircraft, space vehicles, launch vehicles, supporting facilities, other aerospace applications, and related equipment.

Selective Interest: Quality control, quality assurance, and reliability theories, procedures, and practices specifically concerned with developments and techniques for nonaerospace oriented activities that may be unusual or of use within the aerospace effort.

Input Subjects of Specific Interest

- accelerated life testing
- clean rooms (general)
- environmental test facilities
- environmental testing
- failure rates
- fault detection (quality control)
- inspection
- inspection methods
- life prediction
- life testing
- maintainability (procedures and theory)
- nondestructive testing
- quality assurance
- quality control
- radiography (quality control)
- redundancy systems
- reliability (procedures and theory)
- reliability criteria
- sampling techniques (quality control)
- service life
- shock testing (quality control)
- ultrasonic testing (quality control)

39 Structural Mechanics

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structures. For applications see 05 Aircraft Design, Testing and Performance; and 18 Spacecraft Design, Testing and Performance.

Definition

Structural Mechanics – The mechanics of structures and the analysis of their behavior under thermal or mechanical loads by means of structural analysis and structural testing.

NASA Interest

Exhaustive Interest: Theory, design, development and testing of structures and structural elements developed for use in aircraft, space vehicles, and launch vehicles; the static and dynamic responses of such structures.

Selective Interest: Theory, design, development, and testing of lightweight or unusual structures or structural elements of potential aerospace use.

Negative Interest: Structures of structural elements of conventional types utilized in bridges, buildings, ships, ocean platforms, heavy transportation, radio and microwave towers, and the like unless specifically aimed at aerospace use.

Input Subjects of Specific Interest

- acoustoelasticity
- adhesive joints (structural stability)
- aeroelasticity (structural flexibility)
- beams (structures)
- bending
- bolted joints
- bonded structures
- buckling
- columns
- combined loads
- compression
- compression loads
- compression strength (structural)
- cones (structures)
- crack propagation
- cracks
- cylinders (structures)
- dynamic structural analysis
- elasticity
- energy
- energy absorption (structures)
- fatigue (structural)
- filament wound structures (design and tests)
- flutter (structural)
- fracture mechanics
- honeycomb structures
- lightweight structural elements
- lightweight structures
- panels (structures)
- photoelasticity
- plasticity
- plates (structural elements)
- rings (structures)
- riveted joints
- sandwich structures
- self assembling structures
- shear loads
- shear strength (structures)

- shells (structures)
- shock testing (structural analysis)
- stress (structural)
- stress analysis
- structural analysis
- structural design
- structural elements
- structural fatigue
- structural health monitoring
- structural mechanics
- structural testing
- structural theory
- structural vibration effects
- tensile strength (structures)
- tension loads
- thermal stress
- thermoelasticity (structural materials)
- trusses
- vibration (structures)
- vibration testing
- viscoelasticity (structural materials)
- wave propagation (structural response)
- weight analysis
- weld strength
- welded structures

GEOSCIENCES

Includes geosciences (general); earth resources and remote sensing; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography. For related information see also SPACE SCIENCES (categories 88 through 93).

42 Geosciences (General)

Includes general research topics related to the Earth sciences, and the specific areas of petrology, minerology, and general geology. For other specific topics in geosciences see categories 42 through 48.

Definition

Geosciences – Sciences that study the Earth, e.g., its structure, behavior, atmosphere, environment, and global systems.

NASA Interest

Exhaustive Interest: Airborne and spaceborne surveys of the Earth and its resources; evaluation of data collected from such surveys; the Earth's structure and its behavior and global systems.

Selective Interest: Earth studies of potential interest to remote sensing or general planetology, or related to global systems.

Negative Interest: Earth studies having no relation to airborne or spaceborne surveys, to the Earth's structure, properties, or global systems, or to any aerospace science.

Input Subjects of Specific Interest

- craters (Earth)
- Earth sciences
- geology (general)
- geosciences
- minerals (petrology)
- petrography
- petrology

43 Earth Resources and Remote Sensing

Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis of remote sensing data and imagery; development of remote sensing products; photogrammetry; aerial photography; and hydrology. For related instrumentation see 35 Instrumentation and Photography.

Definition

Earth Resources – Power sources and renewable or nonrenewable materials occurring naturally on Earth. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

Remote Sensing – The collection of information about an object or phenomena by a recording device that is not in physical contact with it. The term is usually restricted to mean the methods for, and activity of, recording features and phenomena of the Earth's surface from a remote platform or vehicle. Typically the methods used record reflected or radiated electromagnetic energy, such as radiometry, photometry, spectrometry, and photographic and radar techniques. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: Remote sensing as conducted from the air or from space, supporting ground truth studies.

Selective Interest: Theory, studies, results, developments, mapping, photographic presentations, and the like resulting from and related to earth resources; the Earth's geothermal reservoirs and its solar energy base.

Negative Interest: Geology and geodesy of a routine, earthbound study unless for ground truth or related purposes.

Input Subjects of Specific Interest

- aerial photography
- cartography
- computer processing of Earth resources data
- crop disease detection
- crop forecasts
- desertification
- Earth resources
- foliage sensing
- forest fire detection
- geodesy (remote sensing)
- geological exploration
- geological survey
- geothermal resources
- ground truth
- hydrology
- infrared imagery (remote sensing)
- infrared signatures (earth resources)
- LANDSAT (remote sensing applications)
- limnology
- littoral regions
- mapping
- mineral deposits
- multispectral band scanners (remote sensing applications)
- ocean color (remote sensing)
- orography
- petroleum deposits
- photogrammetry
- radar detection (earth resources)
- radar imagery (remote sensing)

- remote sensing of earth resources
- satellite derived atmospheric profiles
- satellite observation (remote sensing applications)
- scatterometers (remote sensing applications)
- SEASAT (remote sensing applications)
- Shuttle Imaging Radar (earth resources)
- side looking radar (earth resources)
- signature analysis (earth resources)
- snow and ice observations
- sodar detection (remote sensing)
- soil identification
- thematic mapping
- timber inventory
- very long base interferometry (applications)
- water resources

44 Energy Production and Conversion

Includes specific energy conversion systems, e.g., fuel cells; and solar, geothermal, windpower, and waterwave conversion systems; energy storage; and traditional power generators. For technologies related to nuclear energy production see 73 Nuclear Physics. For related information see also 07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power; and 28 Propellants and Fuels.

Definition

Energy Production – The production of electricity, combustible fuels, nuclear and thermonuclear fuels, and heating and cooling by renewable resources.

Energy Conversion – The change of a working substance or natural power into a more useable form of energy such as electricity or mechanical motion. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: Techniques, equipment, and systems that may provide power or fuel for aircraft, space vehicles, launch vehicles, satellites, orbital stations, extraterrestrial bases.

Selective Interest: Earth based energy production and conversion, energy for transportation, and new developments in energy technology (new sources, high efficiency units, etc.); lightweight, low cost power units with potential for aerospace application.

Negative Interest: Solar, wind, nuclear and hydroelectric power plants for routine commercial applications; coal energy conversion.

Input Subjects of Specific Interest

- alternative energy sources
- Brayton cycle turbines (applications)
- chemical energy conversion devices
- electric batteries (applications)
- electric energy conversion devices
- energy management technology
- energy production
- energy storage
- fuel cells
- generators (applications)
- geophysical energy conversion devices
- hybrid energy conversion devices
- magnetohydrodynamic (MHD) energy conversion device
- microwave energy conversion devices
- microwave energy transmission
- photovoltaic energy conversion devices
- silicon cells (applications)
- solar cells (energy conversion)
- solar generators
- solar heating (space applications)
- solar panels (energy conversion)
- solar power (space applications)
- thermionic energy conversion devices
- thermoelectricity
- windpower

45 Environment Pollution

Includes atmospheric, water, soil, noise, and thermal pollution.

Definition

Environment Pollution – Alterations of the natural environment that are harmful to life; normally as produced by human activities. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: Air, noise, thermal, atmospheric pollution, and contamination resulting from air, earthbound, and space transportation.

Selective Interest: Industrial, commercial, and residential air, noise, and thermal atmospheric and water pollution as it impacts air and space transportation, or is monitored by aircraft or spacecraft.

Negative Interest: Air, noise, thermal, water pollution, sewage pollution, and contamination from industrial, commercial, and residential sources with no relation to aerospace activities.

Input Subjects of Specific Interest

- aerosols (pollution aspects)
- air pollution
- atmospheric analysis (pollution)
- atmospheric pollution
- atmospheric sampling (pollution)
- biosphere (pollution aspects)
- commercial pollution
- contamination control
- environmental clean up
- environmental engineering
- environmental modifications
- environmental monitoring
- environmental pollution
- environmental surveys
- exhaust emissions (pollution)
- greenhouse effect (pollution aspects)
- indoor air pollution
- industrial pollution
- noise abatement
- noise pollution
- ozone depletion (pollution aspects)
- pollution control
- pollution monitoring
- radiative forcing (pollution aspects)
- radioactive contamination
- residential pollution
- soil pollution
- sonic boom (noise pollution)
- stratospheric pollution
- thermal pollution
- transportation pollution
- waste treatment (pollution control)
- water pollution
- water treatment (pollution control)

46 Geophysics

Includes earth structure and dynamics, aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For related information see 47 Meteorology and Climatology; and 93 Space Radiation.

Definition

Geophysics – The physics of the Earth and its environment, i.e., its solid earth, air, waters and (by extension) space. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration. *Dictionary of Technical Terms for Aerospace Use*. Wm. H. Allen, ed., 1965. NASA SP-7.

NASA Interest

Exhaustive Interest: Physics of the Earth, including its atmosphere and its hydrosphere, as revealed by aircraft, satellite, and manned spacecraft observations; observation of natural phenomena; upper atmosphere and ionosphere; geomagnetism and Earth gravitational field; paleontology related to development of life; geological investigations having potential relevance to ground truth for remote sensing or Earth evolution and structure.

Selective Interest: Geology of direct interest to aerospace activities.

Negative Interest: Surface surveys; surface or seismic prospecting; assaying processes or records.

Input Subjects of Specific Interest

- aeronomy
- aerosols (atmospheric physics)
- air glow
- atmospheric boundary layers (atmospheric physics)
- atmospheric circulation (atmospheric physics)
- atmospheric density
- atmospheric electricity
- atmospheric optics
- atmospheric physics
- atmospheric radiation
- atmospheric scattering
- atmospheric structure
- atmospheric studies (physical processes)
- atmospherics
- aurora
- biosphere (physical processes)
- continental drift
- Earth magnetic field
- Earth origins
- Earth structure
- Earth-reflected radiation
- fault detection (geological)
- general circulation models (atmosphere)
- geochemistry
- geodesy (physics)
- geological surveys
- geology (Earth structure)
- geomagnetism
- geomorphology
- geophysical sensors (applications)
- geophysics
- glaciology
- gravitational anomalies (terrestrial)
- gravitational theory (terrestrial)
- gravitational waves (terrestrial)
- greenhouse effect (atmospheric physics)
- hydrosphere studies

- infrared spectrometry (atmosphere)
- ionosphere (Earth)
- ionospheric electron density
- ionospheric physics
- ionospheric plasmas
- ionospheric scintillation
- lithology
- lower atmosphere studies
- magnetism (terrestrial)
- magnetosphere (Earth)
- noctilucent clouds
- ozone depletion (atmospheric physics)
- plate tectonics
- rocket/balloon geophysical studies
- seismology
- soil mechanics
- soil sampling
- solar-atmosphere interactions
- space geodesy
- stratosphere
- stratospheric circulation
- tectonics
- upper atmosphere studies
- very long baseline interferometry (geophysics applications)
- volcanoes
- whistlers (upper atmosphere)

47 Meteorology and Climatology

Includes weather observation forecasting and modification.

Definition

Meteorology – The study dealing with the phenomena of the atmosphere especially as they relate to weather and climate. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

Climatology – Branch of meteorology that studies the average weather conditions and statistical variations for a specified region over an extended period of time. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: Earthbound, air, and space observations and measurements of global meteorological conditions and phenomena; weather forecasting of particular interest to, and use by, the aerospace community; and meteorological and climatological satellite studies; unusual global weather systems and climate trends.

Selective Interest: Research and observations not related to aerospace activities, but contributing to a better understanding of weather and climatological problems.

Negative Interest: Routine, day-to-day local weather forecasting.

Input Subjects of Specific Interest

- anabatic winds
- anemometers (applications)
- atmospheric boundary layer (climatology)
- atmospheric circulation (meteorology)
- atmospheric cloud physics
- atmospheric energy exchanges
- atmospheric interactions
- atmospheric studies (meteorological)
- atmospheric turbulence
- barometric pressure
- catabatic winds (also katabatic)
- clear air turbulence (meteorology)
- climate change
- climate models
- climate prediction
- climate variability
- climatology
- cloud cover analysis
- cloud patterns
- cloud seeding
- clouds (meteorology)
- Coriolis forces (meteorology)
- cyclones
- diurnal effects (meteorology)
- el Nino
- energy exchanges in the atmosphere
- fog dissipation and formation
- fronts (meteorology)
- global meteorology
- global warming
- hurricanes
- ice cover (climatology)
- ice crystals (meteorology)
- jet streams (meteorology)
- katabatic winds (also catabatic)
- la Nina

- lightning
- macrometeorology
- meteorological anomalies
- meteorological parameters
- meteorological satellite studies
- meteorological sounding rocket studies
- meteorology
- microbursts
- micrometeorology
- monsoons
- precipitation (meteorology)
- radiative forcing (climate effects)
- rain
- seasonal variations
- snow
- snow cover
- solar-atmospheric interactions
- storm cells
- synoptic meteorology
- temperature variations (meteorology)
- thunderstorms
- tornadoes
- typhoons
- weather forecasting
- weather modification
- wind
- wind shear

48 Oceanography

Includes the physical, chemical and biological aspects of oceans and seas; ocean dynamics; and marine resources. For related information see also 43 Earth Resources and Remote Sensing.

Definition

Oceanography – The science that deals with the study and exploration of seas and oceans. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: Studies by aerospace means of air-sea interactions, marine resources, and the ocean floor; ocean currents and wave phenomena; also marine studies having potential relevance to ground truth for remote sensing and climate modeling.

Selective Interest: Ocean floor core drilling related to age studies, plate movement, and Earth structure.

Negative Interest: Oil and mineral drilling and searching; and fish location.

Input Subjects of Specific Interest

- air-sea interactions
- biological oceanography
- biosphere (oceanography)
- chlorophyll concentration
- dynamic oceanography
- general circulation models (ocean)
- marine biology
- marine resources
- ocean circulation
- ocean currents
- ocean floor studies
- ocean wave studies
- oceanography
- physical oceanography
- phytoplankton concentration
- salinity (oceanography)
- sea ice
- sea water
- sediments (oceanography)
- swash zone (oceanography)
- temperature variations (oceanography)
- thermoclines (oceanography)
- wave phenomena (oceanography)

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and exobiology.

51 Life Sciences (General)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance, of animals and plants in space and related environmental conditions. For specific topics in life sciences see categories 52 through 55.

Definition

Life Sciences – A collective discipline encompassing biology, physiology, psychology, medicine, and sometimes sociology and other related areas. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: Effects of space environments and simulated space environments on plants, animals, and microorganisms; diurnal effects on animals and plants.

Selective Interest: Studies of genetics, sterilization, biology, botany, zoology, and diurnal studies having potential aerospace implications or applications.

Negative Interest: Biological and agricultural research having no relation to aerospace.

Input Subjects of Specific Interest

- acceleration effects (biological, animal and plant)
- altitude effects (biological, animal and plant)
- animal biology
- animal models
- atmospheric pressure effects (biological, animal and plant)
- biochemistry
- bioelectronic instruments (applications, animal and plant)
- bioengineering (general)
- biological evolution (terrestrial)
- biology (general)
- botany
- chronobiology (animal and plant)
- circadian rhythm (animal and plant)
- diurnal effects (biological, animal and plant)
- electromagnetic field effects (biological, animal and plant)
- environmental effects (biological, animal and plant)
- estivation
- farming in space (general)
- genetics (animal and plant)
- gravitational effects (biological, animal and plant)
- hibernation
- immunology
- immunosuppression
- life sciences
- magnetic field effects (biological, animal and plant)

- microbiology
- microgravity effects (biological, animal and plant)
- origin of life (terrestrial)
- osmosis (biological)
- plants
- quarantine (animal and plant)
- radiation effects (biological, animal and plant)
- reduced gravity effects (biological, animal and plant)
- space environment effects (biological, animal and plant)
- telemedicine
- temperature effects (biological, animal and plant)
- weightlessness effects (biological, animal and plant)
- zero gravity effects (biological, animal and plant)

52 Aerospace Medicine

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects of those environments. For psychological and behavioral effects of aerospace environments see 53 Behavioral Science. For the effects of space on animals and plants see 51 Life Sciences.

Definition

Aerospace Medicine – That branch of medicine dealing with the studies and effects of flight through the atmosphere or in space upon the human body and with the prevention or cure of physiological or psychological malfunctions arising from these effects. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration. *Dictionary of Technical Terms for Aerospace Use*. Wm. H. Allen, ed., 1965. NASA SP-7.

NASA Interest

Exhaustive Interest: All general biological and physiological studies and effects of atmospheric and space flight on the human being.

Selective Interest: Stress, physiological, and radiation effects of conventional medicine on the human being with direct application to aerospace flight and environments.

Negative Interest: Medicine, pharmacology, and radiation effects of conventional medicine and biology with no aerospace applications.

Input Subjects of Specific Interest

- acceleration effects (biological, human)
- aerospace medicine
- altitude effects (biological, human)
- anthropometry
- astronaut health (physical)
- atmospheric pressure effects (human)
- bioastronautics
- bioelectronic instruments (aerospace medicine)
- bioengineering (aerospace medicine)
- biomedical instruments (aerospace medicine)
- bone mass
- cardiac physiology (human)
- centrifugal motion effects
- circadian rhythm (human)
- clinical chemistry
- confinement (effects, human)
- Coriolis forces (physiological effects, human)
- deceleration effects (human)
- decompression sickness
- diurnal effects (human)
- dysbarism
- effects of atmospheric flight (human)
- effects of radiation (human)
- effects of space flight (human)
- effects of stress (human)
- electromagnetic field effects (physiological, human)
- environmental effects (human)
- exercise
- extravehicular activity (physiological effects)
- fatigue (physiological, human)
- genetics (human)
- gravitational effects (biological, human)
- high temperature effects (human)
- hypoxia (human)

- low temperature effects (human)
- magnetic field effects (human)
- microgravity effects (human)
- motion sickness
- neuroendocrinology
- orthostatic tolerance
- oxygen generation
- pathology (human)
- perception (biological, human)
- pharmacology
- physiological effects of flight (human)
- physiological factors (human)
- physiological monitoring devices (human)
- physiology (human)
- quarantine (human)
- radiation effects (human)
- radiobiography (human)
- reduced gravity effects (physiological, human)
- sensory deprivation (physiological effects, human)
- sensory organs (human)
- sleep apnea
- sleep deprivation (physiological effects, human)
- space adaptation (physiological, human)
- space environment effects (physiological, human)
- space flight effects (physiological, human)
- stress (physiological effects, human)
- stress effects of atmospheric flight (physiological, human)
- stress effects of space flight (physiological, human)
- temperature effects (human)
- tomography (medical applications)
- toxicology (human)
- vestibular effects (human)
- visual acuity
- weightlessness effects (physiological, human)
- zero gravity effects (physiological, human)

53 Behavioral Sciences

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

Definition

Behavioral Sciences – Sciences such as psychology, sociology, or anthropology that deal with human action and aim to establish generalizations concerning man's behavior in society.

NASA Interest

Exhaustive Interest: Behavior and psychological effects of aerospace environments on humans, alone or in groups; and the mental adaptation to flight in the Earth's atmosphere or in space.

Selective Interest: Mental and emotional effects of small group behavior, isolation, confinement, and the like as they might affect aerospace flight adaptation of man.

Negative Interest: Clinical psychology and psychiatry that would have little or no application to aerospace activities.

Input Subjects of Specific Interest

- astronaut health (psychological)
- astronaut selection
- aviation psychology
- behavioral sciences
- confinement (psychological effects, human)
- crew evaluation
- crew training
- effects of radiation (psychological, human)
- effects of stress (psychological, human)
- fatigue (psychological, human)
- flying training
- group behavior
- human behavior
- isolation effects (psychological, human)
- mental adaptation to flight
- perception (psychological, human)
- pilot performance
- psychological effects of flight
- psychological factors
- sensory deprivation (psychological effects, human)
- sleep deprivation (psychological effects, human)
- social interaction
- sociological research (psychology, human)
- space adaptation (psychological effects, human)
- space flight effects (psychological, human)
- stress (psychological effects, human)
- weightlessness effects (psychological, human)

54 Man/System Technology and Life Support

Includes human factors engineering, bionics, man-machine systems, life support, space suits and protective clothing. For related information see also 16 Space Transportation; and 52 Aerospace Medicine.

Definition

Man-Machine System – A system in which the functions of the man and the machine are interrelated and necessary for the operation of the system. *AGARD Multilingual Aeronautical Dictionary*, 1980.

Life Support System – That complex of equipment which provides for the maintained health, comfort, and security of a vehicle occupant. Usage excludes atmospheric control (environmental control) but includes provision of food and water, waste collection and disposal, escape and survival gear. *AGARD Multilingual Aeronautical Dictionary*, 1980.

NASA Interest

Exhaustive Interest: Equipment and systems specifically concerned with the human aspects of aeronautical and space flight.

Selective Interest: Equipment, systems, and life support from non-aerospace activities (other transportation systems, oceanography, mining, industry, and the like) that may have an application in the human aspects of aeronautical and space flight.

Negative Interest: Industrial- and transportation-related equipment, systems, etc. with no aerospace applications.

Input Subjects of Specific Interest

- bioengineering (man-machine systems)
- bioinstrumentation (physiological monitoring)
- bionics
- cabin pressurization (life support)
- closed ecological systems
- diets (space missions)
- extravehicular activity (EVA) (equipment)
- farming in space (life support)
- flight suits
- food (space missions)
- food preparation (space missions)
- food storage (space missions)
- helmets
- human factors engineering
- human productivity in space
- life support
- man-machine systems
- manned maneuvering units
- man-system interfaces
- oxygen systems (life support)
- pressurized cabins (life support)
- protection measures (human)
- protective clothing
- quarantine procedures
- radiation safety measures (physiological)
- remote manipulator arms (human interface)
- space cabin atmosphere
- space cabin oxygen supplies
- space cabin water supplies
- space flight feeding
- space habitats
- space hygiene
- space sanitation
- space suits

- spacecraft sterilization (interior)
- teleoperators (human interface)
- waste products conversion (aerospace vehicles)
- waste products disposal (aerospace vehicles)
- waste products storage (aerospace vehicles)
- work place design

55 Exobiology

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see 52 Aerospace Medicine; on animals and plants see 51 Life Sciences. For psychological and behavioral effects of aerospace environments see 53 Behavioral Science.

Definition

Exobiology – Field of biology that deals with the search for extraterrestrial life and the conditions that may give rise to life on other planets or elsewhere in the Universe. May also be defined to include the study of effects of extraterrestrial environments on living organisms. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: All facets of biology concerning outer space (beyond the Earth's atmosphere) and the planets (other than planet Earth); including the search for extraterrestrial life and the origin of life in the Universe.

Selective Interest: Biological research concerned with the nature and origin of life on Earth; the chemical composition, growth, development, and reproduction of life on Earth; the adaptation of life to extremes of altitude, temperature, atmospheric conditions, drought, etc. with possible applications to exobiology and the search for extraterrestrial life.

Negative Interest: Medical, agricultural and botanical, animal, and microbial biology as it relates to and results from existing earthbound life.

Input Subjects of Specific Interest

- abiogenesis
- amino acid analysis (extraterrestrial)
- astrobiology
- biochemical detection of life
- bioinstrumentation (extraterrestrial life)
- biology (extraterrestrial)
- biomarkers (exobiology)
- chemical evolution
- culturing, cell (exobiology)
- enzyme analysis (extraterrestrial)
- exobiology
- extraterrestrial biochemistry
- extraterrestrial biology
- extraterrestrial environment effect (exobiology)
- extraterrestrial life
- extraterrestrial water
- extreme temperature effects (exobiology)
- gravitational effects (exobiology)
- life detection
- magnetic field effects
- nature of life
- origin of life (extraterrestrial)
- planetary biology
- protobiological evolution
- reproduction of extraterrestrial life
- soil sampling and analysis (extraterrestrial life)
- space biology
- spontaneous generation of life

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics, artificial intelligence and robotics; numerical analysis; statistics and probability; systems analysis and operations research; and theoretical mathematics.

59 Mathematical and Computer Sciences (General)

Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see categories 60 through 67.

Definition

Mathematics – The study of the logical relationships among abstract entities. These relationships are expressed in numbers, symbols, and signs and may also be applied to concrete instances such as measures and properties of shapes. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

Computer Sciences – The study of the development and use of electronic and optoelectronic devices that store, process, and retrieve information, and of theoretical and applied disciplines that are related and have contributed to these devices and their capabilities.

NASA Interest

Exhaustive Interest: Mathematics and computer theory and technology used in aerospace systems or used to model aerospace equipment or natural space phenomena.

Selective Interest: Mathematics and computer science technology having potential aerospace applications.

Input Subjects of Specific Interest

- computer sciences (general)
- information technology (general)
- mathematical sciences (general)

60 Computer Operations and Hardware

Includes hardware for computer graphics, firmware and data processing. For components see 33 Electronics and Electrical Engineering. For computer vision see 63 Cybernetics, Artificial Intelligence and Robotics.

Definition

Computer Operations – The physical and procedural control of computers; also the electronic responses of a computer to instructions.

Computer Hardware – Electronic, optoelectronic, and electromechanical devices that make up a computer.

NASA Interest

Exhaustive Interest: All computer hardware operations and specific hardware in use, under development, or in theory for use in aerospace flight; as test equipment for aerospace hardware, research, or development; for aerospace launch, takeoff, landing, flight control, or navigation.

Selective Interest: Computer operations and specific hardware for land or sea navigation; for transportation control systems; for industrial applications and testing or study purposes with a potential for aerospace application; and for machine tool control.

Negative Interest: Pocket calculators, desk calculators, and computer operations and hardware developed for routine operations such as banking, inventory control, production line control, and the like.

Input Subjects of Specific Interest

- analog computers
- architecture (computers)
- automatic data processors (ADP)
- central processing unit (CPU)
- computer buffers
- computer display devices
- computer graphics (hardware)
- computer hardware
- computer hardware design
- computer interfacing equipment
- computer manufacturing
- computer memory devices
- computer operations
- computer peripheral equipment
- computer printers
- computer storage devices
- computer storage techniques
- computers (hardware)
- data input devices
- data processing
- digital computers
- digital storage devices
- digital storage techniques
- firmware
- flash memory devices
- hybrid computers
- input devices
- mainframes
- mechanical computers
- memory devices (computer)
- microcomputers
- minicomputers
- modems
- multiprocessors (hardware)
- optical scanners (computer, peripheral equipment)

- output devices (computers)
- parallel processing (hardware)
- personal computers
- plotters
- processors (hardware)
- random access memories
- read-only memories
- remote input equipment
- remote readout equipment
- remote terminals
- spaceborne computers
- supercomputers

61 Computer Programming and Software

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

Definition

Computer Programming – The preparation of a formalized sequence of instructions that can be recognized and implemented by a computer. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

Software – All computer programs, procedures, and routines associated with the operation of a computer, including applications, utility, and systems programs; and related documentation.

NASA Interest

Exhaustive Interest: All computer programming and software concerned with aerospace activities including those for flight computers, test facilities, navigation, control, manufacturing, data processing from the results of these activities, and for the purpose of advancing the state-of-the-art of aerospace research and development.

Selective Interest: Computer programming and software from all sources, e.g., transportation, industry, university, etc. that would have possible aerospace application.

Negative Interest: Computer programming and software for routine medical, banking, ship operation, production line control, and the like, not having application to aerospace activities.

Input Subjects of Specific Interest

- algorithms (computer operations)
- CAD (computer aided design)
- CAM (computer aided manufacturing)
- coding techniques (computer programming)
- compilers (software)
- computer aided design (CAD)
- computer aided manufacturing (CAM)
- computer architecture
- computer graphics (software)
- computer programming
- computer routines
- computer software
- computerized simulation (general)
- data acquisition programs
- debugging programs
- diagnostic procedures (software)
- document markup languages (computer programming)
- error correction codes
- fault tolerant software
- flight computer software
- formalism (computer programming)
- interpreters (software)
- object oriented programming
- operating systems (computers)
- programming (computers)
- programming languages
- protocol checking
- service oriented architecture (SOA)
- software debugging
- software engineering
- software reuse
- web services

62 Computer Systems

Includes computer networks and distributed processing systems. For information systems see 82 Documentation and Information Science. For computer systems applied to specific applications, see the associated category.

Definition

Computer Systems – Defined configurations of hardware, software and processes used to fulfill data and information processing requirements.

NASA Interest

Exhaustive Interest: Computer systems used for aerospace applications, e.g., launch control, tracking, navigation, communications, weather forecasting, aerospace data compilation and processing, test data calculation, aeronautical and space vehicle control, etc.

Selective Interest: Computer systems used for data compilation and processing in such fields as navigation, mathematics, manufacturing, earth resources, transportation, information handling, etc., that may have possible aerospace application.

Negative Interest: Computer systems for routine business and commercial operations; manufacturing and industrial operations and control; conventional data compilation and processing for academic purposes unless applicable to aerospace activities.

Input Subjects of Specific Interest

- communications computer systems
- computer networks
- computer systems
- computer systems engineering
- computer time sharing
- data compilation systems
- data management systems
- data processing systems
- distributed data processing
- internets
- local area networks (LAN)
- parallel processing
- self-repairing computer systems
- wide area networks (WAN)

63 Cybernetics, Artificial Intelligence and Robotics

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also 54 Man/System Technology and Life Support.

Definition

Cybernetics – The study of methods of control and communication which are common to living organisms and machines. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration. *Dictionary of Technical Terms for Aerospace Use*. Wm. H. Allen, ed., 1965. NASA SP-7.

Artificial Intelligence – A discipline concerned with the development of computer and extended-robotic systems that can exhibit intelligent action. May also be defined as a sub field of computer science concerned with concepts and methods of symbolic inference by a computer and the symbolic representation of the knowledge to be used in making inferences.

Robotics – A discipline that employs the principles and techniques of mechanical and electrical engineering and artificial intelligence to develop programmable or self-controlled machines that often include sensory systems and a degree of intelligence. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: All aspects of cybernetics, artificial intelligence, and robotics that relate to aerospace activities.

Selective Interest: Cybernetics, artificial intelligence, and robotics of interest to non-aerospace activities that have potential aerospace application.

Input Subjects of Specific Interest

- adaptive control theory
- artificial intelligence
- automata theory
- automatic control
- computer vision
- control systems design
- control theory
- cybernetics
- expert systems
- feed forward control
- feedback control
- filter theory (control)
- information theory
- knowledge based systems
- knowledge representation
- machine learning
- model order reduction (control theory)
- multivariable control
- neural networks
- optimal control
- pattern recognition
- remote manipulator arms (robotics)
- robot control
- robot dynamics
- robot sensors
- robot vision
- robotics
- scene analysis (robotics)
- speech recognition
- support vector machines
- teleoperators (robotics)
- telerobotics
- virtual reality

64 Numerical Analysis

Includes iteration, differential and difference equations, and numerical approximation.

Definition

Numerical Analysis – Study of approximation methods using arithmetic techniques for the solution of mathematical problems. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: All facets of numerical analysis.

Input Subjects of Specific Interest

- algorithms (mathematics)
- approximation
- boundary value problems
- calculus
- collocation methods
- computational grids
- convergence (mathematics)
- difference equations
- differential equations
- differentiation (mathematics)
- eigenvalues/eigenvectors
- finite difference methods
- finite element methods
- finite volume methods
- fourier analysis
- Galerkin method
- grid refinement (mathematics)
- harmonic analysis (mathematics)
- integral equations
- iteration
- mathematical analysis
- matrices
- mesh refinement (mathematics)
- multigrid methods
- numerical analysis
- numerical integration
- perturbation theory (mathematics)
- Rayleigh-Ritz method
- Runge-Kutta method
- spectral methods (mathematics)
- spline functions
- variational methods

65 Statistics and Probability

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

Definition

Statistic – A quantity calculated from a sample of observations, usually as an estimate of some population parameter such as mean or standard deviation. *AGARD Multilingual Aeronautical Dictionary*, 1980.

Probability – A real number in the scale 0-1 attached to a random event. It can be related to a long run relative frequency of occurrence or degrees of belief that an event will occur. *AGARD Multilingual Aeronautical Dictionary*, 1980.

NASA Interest

Exhaustive Interest: All statistical and probability theory, sampling techniques, reliability theory and techniques related to aerospace activities, aircraft and spacecraft control, facilities, development, and manufacturing.

Selective Interest: Statistics and probability related to transportation, agriculture, water pollution, and air pollution of possible aerospace interest or application.

Negative Interest: Statistics and probability concerned with banking, housing, home furnishing, and general manufacturing of a nonaerospace nature.

Input Subjects of Specific Interest

- analysis of variance
- Bayesian statistics
- data sampling
- data smoothing
- error analysis (statistics)
- Markov processes
- martingales
- maximum likelihood estimation
- minimax techniques
- Monte Carlo method
- prediction analysis
- principal components analysis
- probability
- probability density functions
- random sampling
- regression analysis
- sampling techniques (statistics)
- statistical techniques
- statistics
- stochastic processes
- time series analysis
- Weibull distributions

66 Systems Analysis and Operations Research

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

Definition

Systems Analysis – The examination of an activity, procedure, method, technique, or a business to determine what must be accomplished and how the necessary operations may best be accomplished. *AGARD Glossary of Documentation Terms, Third Revision*. H. A. Stolk, ed., 1968.

NASA Interest

Exhaustive Interest: All systems analysis theory and all aerospace related practice, procedures, and applications.

Selective Interest: Systems analysis practice, procedures, and applications from transportation, manufacturing, communications, and scientific fields having potential interest for aerospace activities.

Negative Interest: Systems analysis and operations research related to business, banking, and management with no aerospace applications.

Input Subjects of Specific Interest

- decision theory
- dynamic programming
- game theory
- linear programming
- mathematical modeling (systems analysis)
- mathematical programming
- network analysis
- operations research
- optimization (mathematics)
- queueing theory
- systems analysis

67 Theoretical Mathematics

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

Definition

Theoretical Mathematics – A classificatory term referring to various specialized areas of mathematics and the logic and foundations of mathematics and other formal systems.

NASA Interest

Exhaustive Interest: Mathematical theories applied to aerospace research.

Selective Interest: Mathematical theories with applications that may be of potential use for aerospace activities.

Input Subjects of Specific Interest

- Abelian groups
- algebraic systems
- Banach spaces
- Boolean algebra
- differential geometry
- field theory (mathematics)
- fractals
- functional analysis
- fuzzy sets
- geometry
- graph theory
- group theory
- Hamiltonian functions
- Hilbert spaces
- mathematical logic
- mathematical theories
- number theory
- operator theory (mathematics)
- parentology
- Riemann surfaces
- set theory
- theoretical mathematics

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear physics; optics; plasma physics; solid-state physics; and physics of elementary particles and fields. For related information see also ENGINEERING (categories 31 through 39).

70 Physics (General)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see categories 71 through 77. For related instrumentation see 35 Instrumentation and Photography; for geophysics, astrophysics, or solar physics see 46 Geophysics; 90 Astrophysics; or 92 Solar Physics.

Definition

Physics – The science that studies the elementary principles and laws of nature.

NASA Interest

Exhaustive Interest: The elements of physics as they relate to aeronautics, astronautics, and the aerospace sciences.

Selective Interest: The elements of physics from all fields that might have potential aerospace applications.

Negative Interest: Nuclear physics for weaponry, large-scale commercial electricity generation, and other applications not having aerospace potential.

Input Subjects of Specific Interest

- antigravity
- Brownian movement
- chaos
- dynamics (physics)
- electromagnetic radiation (theory)
- electromagnetism
- electrostatics
- ferromagnetism
- field theory (physics)
- kinetics
- magnetism
- many-body problems
- mechanics (theory and analysis)
- physics
- solitary waves

71 Acoustics

Includes sound generation, transmission, and attenuation. For noise pollution see 45 Environment Pollution. For aircraft noise see also 02 Aerodynamics; and 07 Aircraft Propulsion and Power.

Definition

Acoustics – The study of sound, including its production, transmission, and effects. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration. *Dictionary of Technical Terms for Aerospace Use*. Wm. H. Allen, ed., 1965. NASA SP-7.

NASA Interest

Exhaustive Interest: Acoustic theory, noise generation, sound attenuation, and related phenomena as they apply to aerospace equipment and vehicles and their operating environment. For specific applications see 02 Aerodynamics; 05 Aircraft Design, Testing, and Performance; 07 Aircraft Propulsion and Power; 15 Launch Vehicles and Launch Operations; 18 Spacecraft Design, Testing, and Performance; and 20 Spacecraft Propulsion and Power.

Selective Interest: Noise generation, sound attenuation, and other acoustic phenomena related to other means of transportation, manufacturing, and construction with potential aerospace applications.

Negative Interest: Noise generation, sound attenuation, and acoustic phenomena with no potential aerospace application.

Input Subjects of Specific Interest

- acoustic scattering
- acoustic theory
- acoustics (general)
- aeroacoustics
- aerodynamic noise (general)
- Doppler effect (acoustics)
- noise attenuation
- noise generation
- noise measurement
- noise propagation
- noise reduction (general)
- sodar (theory and techniques)
- sonic boom (theory)
- sound absorption
- sound attenuation
- sound generation
- sound generation in ducts
- sound propagation
- sound transmission
- surface acoustic wave devices (theory)
- ultrasonic applications
- ultrasonic theory
- underwater acoustics
- wave propagation (acoustic)

72 Atomic and Molecular Physics

Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see 77 Physics of Elementary Particles and Fields; for nuclear physics see 73 Nuclear Physics.

Definition

Atomic Physics – The study of the structure and characteristics of atoms. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

Molecular Physics – The study of the structure and characteristics of molecules. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: The basic theories and formulas of atomic and molecular physics as they relate to aeronautics, astronautics, and aerospace sciences. Those elements of atomic and molecular physics that have actual or potential application to the aerospace program.

Selective Interest: Those applications of atomic and molecular science that have potential use to the aerospace sciences.

Negative Interest: Basic theories and formulas of atomic and molecular physics that have no application to the aerospace sciences.

Input Subjects of Specific Interest

- absorption of radiation by atoms
- activation analysis
- atomic beam measurements
- atomic collisions
- atomic electron properties
- atomic energy levels
- atomic frequency standards
- atomic fuels (space applications)
- atomic nuclei
- atomic physics
- atomic reactions
- atomic spectra
- atomic structure
- electron collisions
- electron scattering
- emission of radiation by atoms
- fluorescence
- intermolecular forces
- ion beams (theory)
- ion dynamics
- ion exchange
- luminescence (atomic physics)
- molecular beams
- molecular collision theory
- molecular energy
- molecular interactions
- molecular physics
- molecular properties
- molecular spectra
- molecular spectroscopy
- molecular structure
- photon interactions with atoms and molecules
- radiation absorption by atoms
- theories of atomic physics
- theories of molecular physics

73 Nuclear Physics

Includes nuclear particles; and reactor theory. For space radiation see 93 Space Radiation. For atomic and molecular physics see 72 Atomic and Molecular Physics. For elementary particle physics see 77 Physics of Elementary Particles and Fields. For nuclear astrophysics see 90 Astrophysics.

Definition

Nuclear Physics – The study of the structure and characteristics of atomic nuclei. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: The basic theories and formulas of nuclear physics and testing and research equipment to support these developments as they relate to aeronautics, astronautics, and aerospace sciences.

Selective Interest: Those applications of nuclear physics that may be of use to the aerospace program, e.g., propulsion systems and power sources, suitable for aerospace use.

Negative Interest: Large, commercial nuclear reactor applications; ship propulsion reactors.

Input Subjects of Specific Interest

- alpha rays (theory)
- beta rays (theory)
- electron beams
- gamma rays (theory)
- ion beams (nuclear interactions)
- nuclear decay
- nuclear engines (theory)
- nuclear fission
- nuclear fuels
- nuclear fusion (theory)
- nuclear magnetic resonance
- nuclear particles
- nuclear physics
- nuclear power sources (theory)
- nuclear propulsion systems (theory)
- nuclear reactions
- nuclear reactor theory
- nuclear reactors
- nuclear research equipment
- nuclear scattering
- nuclear structure
- nuclear test equipment
- proton beams (nuclear interactions)
- radioisotopes
- reactor radiation safety measures (space applications)
- reactor theory
- space-power reactors (theory)
- x-ray radiation (theory)

74 Optics

Includes light phenomena and the theory of optical devices. For lasers see 36 Lasers and Masers.

Definition

Optics – Branch of physical science concerned with the transmission, generation, manipulation, and detection of electromagnetic radiation in the wavelength range from vacuum ultraviolet to the far infrared. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: Theories of light transmission and lenses, light absorption, reflection, and scattering as they relate to aeronautics, astronautics, and space sciences.

Selective Interest: Optics and light phenomena with potential aerospace use.

Negative Interest: Industrial, commercial, and household applications of optics and light phenomena, lenses, and eyeglasses.

Input Subjects of Specific Interest

- Bragg cells (optical applications)
- Cassegrain optics
- coherent light
- electron optics theory
- fiber optics
- geometrical optics
- infrared optics
- infrared radiation effects (optical applications)
- infrared signatures (optical applications)
- infrared spectra
- lens theory
- lenses (optical properties)
- light absorption
- light reflection
- light scattering
- light transmission
- liquid optics
- luminescence (optics)
- mirror interference (optics)
- modulation (optics)
- nonlinear optics
- optical bistability
- optical coatings
- optical communications (theory)
- optical fibers
- optical imaging devices (theory)
- optical materials
- optical properties
- optical waveguides
- optics
- optoelectronics (optics)
- photon beams
- photonics
- polarization (optics)
- refraction (optics)
- Schlieren optics
- telescopes (optical properties)
- tomography (optics)
- ultraviolet radiation (optics)
- wave propagation (optics)
- x-ray optics

75 Plasma Physics

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 Geophysics. For space plasmas see 90 Astrophysics.

Definition

Plasma Physics – The study of the nature and properties of highly ionized gases (comprised of ions and free electrons). *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: Theoretical magnetohydrodynamics and plasma fusion; research and test equipment for studies in plasma physics as related to aerospace sciences.

Selective Interest: Applications of magnetohydrodynamics and plasma fusion that may be of interest for propulsion, power sources, and other uses in the aerospace program.

Negative Interest: Heavy industrial and commercial applications; large power reactors.

Input Subjects of Specific Interest

- electrogasdynamics
- electrohydrodynamics
- electron density (plasma physics)
- fusion devices
- hydromagnetics (plasma physics)
- ion beams (plasma physics)
- laser interaction with plasmas
- magnetogasdynamics
- magnetohydrodynamics
- magnetoplasmas
- MHD generators
- microwave interaction with plasmas
- mirror machine (plasma physics)
- nuclear fusion (plasma physics)
- plasma conductivity
- plasma diagnostics
- plasma dynamics
- plasma flow
- plasma fusion
- plasma oscillations
- plasma physics
- plasma physics research equipment
- plasma pinch
- plasma propulsion (theory)
- plasma seeding
- plasma sheath
- plasma theory
- plasma waves
- stellarators
- tokamak devices
- whistlers (plasma physics)

76 Solid-State Physics

Includes condensed matter physics, crystallography, and superconductivity. For related information see also 33 Electronics and Electrical Engineering; and 36 Lasers and Masers.

Definition

Solid-State Physics – The study of the physical structure and properties of solid matter, including electrical conduction in metal crystals and semiconductors, superconductivity, and photoconductivity. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: All facets of solid-state physics and the solid-state effects in electrical and electronic devices as they relate to aeronautics, astronautics, and aerospace sciences.

Selective Interest: Commercial applications of solid-state physics that might have a potential for use in aerospace applications.

Negative Interest: Solid-state physics with no application to aerospace science.

Input Subjects of Specific Interest

- acceptors (solid state)
- band structure of solids
- condensed matter physics
- conductivity (solid state)
- critical field curves of superconducting materials
- critical temperatures of superconducting materials
- crystal defects
- crystal growth (general)
- crystal structure (semiconductors)
- crystallography
- dielectric materials properties
- donors (solid state)
- electrical transport properties in solids
- electron energy bands
- electron motion in conductors
- electron paramagnetic resonance (solid state)
- energy gaps in semiconductors
- epitaxy
- holes (electron deficiencies)
- lattice vibrations
- liquid crystals
- Mossbauer effect
- piezoelectricity
- radiation effects in semiconductors
- semiconductor materials
- solid state physics
- solidification (solid state)
- superconducting materials
- superconductivity (theory)
- thermoelectric materials
- thin films (theory, deposition and growth)

77 Physics of Elementary Particles and Fields

Includes quantum mechanics; theoretical physics; and statistical mechanics. For related information see also 72 Atomic and Molecular Physics; 73 Nuclear Physics; and 25 Inorganic, Organic and Physical Chemistry.

Definition

Elementary Particle Physics – Branch of physics concerned with the nature and properties of subatomic particles especially through the study of high-energy collisions and decays.

Statistical Mechanics – Branch of physics concerned with predictions of the behavior of macroscopic systems based on the interactions of the microscopic constituents of the system, where the number of constituents is very large. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Selective Interest: Aspects of elementary particles, field theory, and statistical physics for those applications that may be of use to the aerospace program.

Input Subjects of Specific Interest

- annihilation reactions
- antimatter
- antiparticles
- baryons
- Boltzmann statistics
- Bose and Fermi statistics
- bosons
- elementary particle interactions
- elementary particles
- fermions
- Feynman diagrams
- gauge field theory
- high energy physics
- kaons
- leptons
- mesons
- momentum transfer (particle interactions)
- neutrinos
- neutron properties
- neutron sources
- neutron spectra
- particle physics
- pions
- quantum chromodynamics (QCD)
- quantum electrodynamics (QED)
- quantum mechanics
- quarks
- standard model (particle physics)
- statistical physics
- string theory
- strong interactions (field theory)
- supergravity
- superstring theory
- supersymmetry
- symmetry breaking
- theoretical physics
- theory of relativity
- unified field theory
- weak interactions (field theory)

SOCIAL AND INFORMATION SCIENCES

Includes social and information sciences (general); administration and management; documentation and information science; economics and cost analysis; law, political science, and space policy; and technology utilization and surface transportation.

80 Social and Information Sciences (General)

Includes general research topics related to sociology; educational programs and curricula.

Definition

Social Sciences – A group of sciences dealing with special phases of human society such as economics, sociology, political science, ethics, and education.

NASA Interest

Exhaustive Interest: Sociological research as it relates to aerospace professional groups, and opportunities, and scientific education; socioeconomic impact of aerospace and aerospace related subjects.

Selective Interest: Sociological studies with potential application to aerospace research activities.

Negative Interest: Social studies having no application to aerospace programs.

Input Subjects of Specific Interest

- educational curricula
- educational programs
- social sciences
- sociological research (humanities)

81 Administration and Management

Includes management planning and research.

Definition

Administration – The act of performing, or people who perform executive functions for an entity such as an institution or a business.

Management – Act or art of conducting, directing, supervising, or controlling the operation of a business, enterprise, or similar endeavor.

NASA Interest

Exhaustive Interest: Administration and management of NASA programs and the aerospace industrial activities.

Selective Interest: Administration and management techniques and assessment of technology applicable to aerospace research activities.

Negative Interest: Routine administration or management with no application to aerospace research activities.

Input Subjects of Specific Interest

- administration
- administrative planning
- budgeting (management)
- contract procurement
- contract supervision
- critical path method
- decision making
- management
- management planning
- management research
- management tools
- PERT (Program Evaluation and Review Technique)
- program management
- project management
- research management
- research planning
- space commercialization (management)

82 Documentation and Information Science

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer program documentation see 61 Computer Programming and Software.

Definition

Documentation – The creating, collecting, organizing, storing, citing, and disseminating of documents, or the information recorded in documents. *Compilation of Terms in Information Sciences Technology*. Florence Casey, ed. Federal Coordinating Council for Science and Technology, April 1970.

Information Science – The study of generating, acquiring, processing, storing, retrieving, disseminating, and using information; and the development of methods for the useful organization of data and dissemination of information. *Compilation of Terms in Information Sciences Technology*. Florence Casey, ed. Federal Council for Science and Technology, April 1970.

NASA Interest

Exhaustive Interest: All facets of documentation and information science theory applicable to the processing, retrieval, and dissemination of aerospace information.

Selective Interest: Documentation and information science methods and procedures of possible application to the processing, retrieval, and dissemination of aerospace information.

Negative Interest: Public or community library procedures and techniques.

Input Subjects of Specific Interest

- copyright regulations
- databases
- document markup languages (information transfer)
- document miniaturization
- document processing
- documentation
- geographical information systems
- graphic arts
- information retrieval
- information science
- information storage
- information systems
- internet resources
- language translation
- lexicography
- library science
- manuals (refer to appropriate category for manuals)
- mechanical drawing
- microfiche techniques
- micrography
- project documentation
- reprography
- Space Station Information System
- technical writing

83 Economics and Cost Analysis

Includes cost effectiveness studies.

Definition

Economics – Study of the production, distribution, and consumption of goods and services. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

Cost Analysis – Examination of the effects on expenses and profits of various procedures that might be used by a business or enterprise in creating or supplying its goods or services.

NASA Interest

Exhaustive Interest: Those elements of economics and cost analysis that would directly impact the aerospace program.

Selective Interest: Those elements of economics and cost analysis that would have possible application to the aerospace program, e.g., production forecasts, marketing predictions, or aerospace transportation funding forecasts.

Negative Interest: The economics and cost analysis of household, routine business and marketing, manufacturing, and local, state, and Federal government procedures that have no impact on aerospace activities.

Input Subjects of Specific Interest

- aircraft production economic
- airline economics
- cost analysis
- cost effectiveness studies
- economic impacts
- economics
- insurance (aerospace)
- marketing predictions
- marketing research
- production costs
- production forecasts
- space transportation economics
- transportation funding forecasts (aerospace)

84 Law, Political Science and Space Policy

Includes; aviation law; space law and policy; international law; international cooperation; and patent policy.

Definition

Law (Jurisprudence) – A written rule or collection of rules for action or conduct binding upon the population of a community. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: All aspects of law and political science, both domestic and international, that are concerned with or directly affect the aerospace programs.

Negative Interest: Domestic and international civil law, shipping and other transportation law, and political science.

Input Subjects of Specific Interest

- aerospace agreements
- air piracy (legal aspects)
- air transport regulations
- civil aeronautical law
- commercial spaceflight (regulation)
- congressional legislation
- federal aviation laws
- government/industry relationships
- international cooperation
- international law
- law
- legal liability of commercial aviation
- legal liability of general aviation
- legal liability of manned space flight
- legal liability of unmanned space flight
- patent law
- patent policy
- political science
- space commercialization (legal aspects)
- space law
- space policy
- transfer of responsibility (space applications)
- treaties

85 Technology Utilization and Surface Transportation

Includes aerospace technology transfer; urban technology; surface and mass transportation. For related information see also 03 Air Transportation and Safety; 16 Space Transportation and Safety; and 44 Energy Production and Conversion. For specific technology transfer applications see also the category where the subject is treated.

Definition

Urban Technology – The application of aerospace development to city problems.

Urban Transportation – The conveyance of, or means for conveying, people and goods in and around cities.

NASA Interest

Exhaustive Interest: NASA program spin-offs

Selective Interest: Surface and mass transportation that might serve NASA or provide improved transportation as a result of the NASA aerospace effort.

Negative Interest: Routine ship, railroad, bus, trucking, or automotive transportation.

Input Subjects of Specific Interest

- air cushion vehicles
- electric vehicles
- fresh water sources
- global position system (surface navigation)
- ground effect machines
- hybrid vehicles
- hydrofoil vehicles
- land transportation vehicles (development and technology)
- maglev vehicles
- mass transportation
- rapid transit systems
- sewage disposal
- space technology applications to urban problems
- surface transportation
- technology transfer
- technology utilization
- urban technology
- urban transportation
- waste products conversion (urban technology)
- waste products disposal (urban technology)
- waste treatment (development and technology)
- water treatment (development and technology)

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary science and exploration; solar physics; and space radiation. For related information see also GEOSCIENCES (categories 42 through 48).

88 Space Sciences (General)

Includes general research topics related to the natural space sciences. For specific topics in Space Sciences see categories 89 through 93.

Definition

Space Sciences – The specific discipline associated with the development of knowledge about the universe. *Apollo Terminology*, August 1963. NASA SP-6001.

NASA Interest

Exhaustive Interest: Scientific studies of the regions beyond the Earth's atmosphere.

Negative Interest: Pseudoscientific reports on the universe and unidentified flying objects.

Input Subjects of Specific Interest

- space sciences (general)

89 Astronomy

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

Definition

Astronomy – The science that treats of the location, magnitudes, motions, and constitution of celestial bodies and structures. The science now includes a number of specialized branches such as radio astronomy, X-ray astronomy, astrometry, astrophysics, celestial mechanics, and cosmology. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: Except for astrophysics, all facets of astronomy including radio and gamma-ray astronomy, observations of celestial bodies, their structure, motions, and locations.

Input Subjects of Specific Interest

- asteroid belt
- asteroids (observation)
- astrometry
- astronomical instruments
- astronomy
- binaries (observation)
- black holes (observation)
- celestial bodies (observation)
- celestial motion (observation)
- comets (observation)
- discovery of celestial bodies
- ephemerides of celestial bodies
- extrasolar planets (observation)
- galaxies (observation)
- gamma-ray astronomy
- Hubble telescope
- identification of celestial bodies
- infrared astronomy
- infrared telescopes
- JWST (James Webb Space Telescope)
- Large Space Telescope
- meteoroids (observation)
- meteors (observation)
- moons (observation)
- natural satellites (observation)
- nebulae (observation)
- novae (observation)
- observation of celestial bodies
- observatories
- occultation (astronomy)
- optical telescope facilities
- optical telescopes
- planet location
- pulsars (observation)
- quasars (observation)
- radar telescope and range finder facilities
- radar telescopes
- radio astronomy
- radio telescope facilities
- radio telescopes
- spaceborne astronomy
- spectroscopy (astronomy)
- star trackers (observation)
- stars (observation)
- stellar spectroscopy

- supernovae (observation)
- telescopes (operation)
- ultraviolet astronomy
- x-ray astronomy
- x-ray telescopes
- zodiacal light

90 Astrophysics

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

Definition

Astrophysics – Study of the physical characteristics and processes associated with celestial bodies and interstellar space. The application of the laws of physics to the study of the celestial bodies and astronomical phenomena such as luminosity, size, mass, density, temperature, and chemical composition. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: All facets of the physical properties of celestial bodies, interplanetary, interstellar, and intergalactic properties; data analysis and calculations of celestial mechanics. For planetary science see 91 Lunar and Planetary Science and Exploration.

Input Subjects of Specific Interest

- astrochemistry
- astrophysics
- binaries (astrophysics)
- black holes (astrophysics)
- celestial body orbits
- celestial body physical properties
- celestial body trajectories
- celestial mechanics
- cosmic dust
- cosmic noise
- cosmology
- dark energy
- dark matter
- expansion of the universe
- galactic evolution
- galactic structure
- galaxies (astrophysics)
- galaxy clusters
- gravitational collapse (astrophysics)
- gravitational theory (astrophysics)
- gravitational waves (astrophysics)
- hydromagnetics (astrophysics)
- intergalactic dust
- intergalactic gases
- intergalactic matter
- interplanetary dust
- interplanetary gases
- interplanetary matter
- interplanetary shock waves
- interstellar dust
- interstellar gases
- interstellar matter
- Magellanic clouds
- magnetism (extraterrestrial)
- nebulae (astrophysics)
- novae (astrophysics)
- nuclear astrophysics
- physical properties of celestial bodies
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- quasars (astrophysics)
- solar system evolution
- space plasmas
- stars (astrophysics)
- stellar evolution
- stellar luminosity

- stellar magnetic fields
- stellar mass accretion
- stellar physics
- stellar systems
- supernovae (astrophysics)
- universe

91 Lunar and Planetary Science and Exploration

Includes planetology; selenology; meteorites; comets; craters; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see 18 Spacecraft Design, Testing and Performance.

Definition

Lunar Exploration – Scientific investigation of the moon by means of probes or manned or unmanned missions.

Planetary Exploration – Scientific investigation of the planets and their satellites, asteroids and other bodies by means of manned or unmanned missions.

NASA Interest

Exhaustive Interest: All facets of lunar and planetary sciences, and manned, unmanned, or remote exploration of planets and their structure, including planets within the solar system or elsewhere within the universe.

Input Subjects of Specific Interest

- asteroids (characteristics and composition)
- cis-lunar space environment
- comet exploration
- comets (characteristics and composition)
- craters (extraterrestrial)
- dwarf planets
- Earth analogs
- extraterrestrial roving vehicles
- flyby missions
- gas giant planets
- lunar and planetary resource utilization
- lunar and planetary resources
- lunar evolution
- lunar exploration
- lunar landing sites
- lunar mapping
- lunar photography
- lunar regolith simulants
- lunar samples
- lunar structure
- manned flights (space exploration)
- manned lunar exploration
- manned Mars missions
- manned planetary exploration
- Mars exploration
- meteorites
- meteoroids
- meteors
- moons (characteristics and composition)
- natural satellites (characteristics and composition)
- planetary atmospheres
- planetary evolution
- planetary exploration
- planetary mapping
- planetary motion
- planetary photography
- planetary samples
- planetary satellites (characteristics and composition)
- planetary structure
- planetology
- remote exploration of planets
- selenography
- selenology
- soil sampling and analysis (planetology)
- solar system bodies
- tektites
- terrestrial planets
- trans-lunar space environment
- unmanned flights (space exploration)
- unmanned lunar exploration
- unmanned planetary exploration

92 Solar Physics

Includes solar activity, solar flares, solar radiation and sunspots. For related information see 93 Space Radiation.

Definition

Solar Physics – The study of the structure and activities of the Sun. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: All facets of solar physics.

Input Subjects of Specific Interest

- alpha rays (solar)
- beta rays (solar)
- chromosphere (solar)
- coronal mass ejections (solar)
- heliophysics
- heliosphere
- lunar eclipses
- photosphere (solar)
- solar activity
- solar atmosphere
- solar constants
- solar corona
- solar cycles
- solar density
- solar eclipses
- solar flares
- solar magnetic field
- solar mass
- solar physics
- solar radiation
- solar radio emissions
- solar spectra
- solar structure
- solar wind
- sun
- sunspots

93 Space Radiation

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see 51 Life Sciences; on human beings see 52 Aerospace Medicine. For theory see 73 Nuclear Physics.

Definition

Extraterrestrial Radiation – Electromagnetic or particle radiation emitted from a source beyond the Earth's atmosphere. *NASA Thesaurus*, Washington, DC: National Aeronautics and Space Administration.

NASA Interest

Exhaustive Interest: All facets of space radiation.

Input Subjects of Specific Interest

- alpha rays (space)
- beta rays (space)
- cosmic radiation
- galactic radiation
- gamma rays (space)
- inner Earth radiation belts
- intergalactic radiation
- interstellar radiation
- outer Earth radiation belts
- radiation belts
- space radiation
- stellar radiation
- ultraviolet radiation (space)
- Van Allen belts
- x-ray radiation (space)

GENERAL

Includes aerospace related reports of a general or broad nature; histories, biographies, or overviews of aerospace programs.

99 General

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.

NASA Interest

Exhaustive Interest: Histories of NASA programs and missions; biographies of NASA astronauts; NASA appropriations hearings.

Selective Interest: Histories of aeronautics and astronautics; biographies of astronauts, aviation pioneers, pilots and aerospace related scientists; reports on aerospace subjects of such wide coverage and of such broad nature that no predominate or suitable subject category can be found.

Negative Interest: Histories, biographies, or reports that are unrelated to aerospace.

Input Subjects of Specific Interest

- aeronautical history
- appropriations hearings (NASA)
- astronautical history
- biographies of astronauts, aviation pioneers, pilots, and scientists
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